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PROMOTION OF THE MECHANIC ARTS.

MAY, 1852.

CIVIL ENGINEERING.

Extract from the Report to the Secretary of the Treasury, on Light-Houses of the United States.

Continued from page 238.

That the board respectfully recommend to the honorable Secretary of the Treasury, to direct that pending the future action of Congress on the subject of light-house improvements, the 7th section of the act making appropriations for light-houses, light-boats, buoys, &c., approved March 3d, 1851, in the following words:

Sec. 7. *And be it further enacted:* "That hereafter in all new light-houses, in all light-houses requiring new lighting apparatus, and in all light-houses as yet unsupplied with illuminating apparatus, the lens, or Fresnel system, shall be adopted, if in the opinion of the Secretary of the Treasury, the public interest will be subserved thereby," be strictly carried out, and that the necessary illuminating apparatus to fit up the light-houses now authorized to be built shall be of the lens system.

That a rigid and frequent inspection and superintendence by competent persons is essential to an efficient light-house establishment, and the board, therefore, recommend the appointment from the Army and Navy of a suitable number of inspectors for the lights and their accessories, throughout the United States.

That the present light-house establishment requires a thorough organization to ensure to the service, efficiency and economy, and therefore

the board recommend the organization of a light-house board, to be composed of Scientific Civilians, Army and Navy officers, to be charged, by law, with the entire management of the light-house establishment of the United States.

That all sea-coast and other 1st class lights should have not less than two keepers, including all 1st and 2d order lens lights.

That all constructions, renovations, and repairs of towers and buildings, be hereafter made upon the plans, estimates, and drawings, and under the personal superintendence of an officer of engineers of the Army, in conformity to the 9th section of the act making appropriations for light-houses, light-boats, buoys, &c.; approved March 3, 1851.

That the lanterns, and all apparatus for illumination, ventilation, &c., &c., be constructed under the personal superintendence of an officer of engineers of the Army.

That the sea-coast lights be increased in power and range.

That all light vessels not yet fitted with illuminating apparatus requiring to be renovated, and all that may hereafter be authorized by law, be fitted with the best system of lamps and parabolic reflectors, both for fixed and revolving lights.

That more attention be given to the subject of models for light-vessels, constructing and mooring them so as to give greater assurance to the navigator, that they will be always found in position.

That light vessels be painted and fitted with distinguishing marks by day, to enable the mariner to know them without difficulty.

That there be a uniformity in painting, marking, and distinguishing beacons; and that no one be allowed to change the color or distinguishing marks of any beacon, sea mark, or light-house, without authority from the proper office at Washington, and after ample notice shall have been given through the medium of the commercial papers of greatest circulation, and by placards distributed at the different custom-houses, both at home and abroad, and among consuls and commercial agents of maritime nations.

That the buoys be made in size to subserve their proposed purpose, and that different shapes be employed for different channels, dangers, &c., &c.

That competent professional men be required to make frequent inspections of the lights and other aids to navigation along the entire coast.

That supplies of all kinds undergo a most rigid test and scrutiny by a professional person of high moral and social standing, before issuing them to light-keepers.

That light-keepers undergo an examination before being placed in charge of any light, and that they be instructed by a competent person upon the detail of all the duties confided to them.

That instructions, rules, and regulations, embracing every point of duty, be drawn up in clear, plain, and explicit terms, suited to the capacities of the persons for whose benefit they are prepared, and distributed to the light-keepers and others connected with the service; that the general rules and regulations be printed in large type, with conspicuous headings, and framed, so that the keepers may always have access to them; and those more in detail to be well bound, and the keepers required to transfer them to their successors should they leave the lights.

That frequent and rigid inspections of lights by districts be made by competent professional men, and that they make regular returns to the head of the light-house department.

That the keepers be required to keep meteorological and tidal registers, in addition to the necessary returns of the daily consumption of oil and other supplies.

That no light-house keeper be appointed who cannot read and write, and is not in other respects competent to the faithful discharge of the duties.

That a mode of supplying persons employed at lights on rocks or other isolated points, on board of light vessels, &c., &c., with rations, to enable them to devote their entire time and attention to the duties, should be adopted.

That light-keepers be required to devote their entire time and attention to their duties on pain of dismissal, and in no case should a keeper be allowed to follow any other vocation to the neglect of the light.

That no keeper be allowed to be absent from the light without a positive written permission from the district inspector.

That no one but a regularly appointed keeper, and his assistant or assistants, be permitted to attend to the apparatus, lighting, &c., &c., of a light-house or light vessel.

That the best cleaning powders, rags, &c., trimming scissors, and other necessary articles for keeping good lights, be furnished to the keepers; and that they be instructed that, under no pretext, should they employ any other means for keeping their apparatus in good order than those pointed out in the printed instructions from the Department.

That proper curtains be provided for the apparatus of each light-house, &c.

That light vessels never be removed from their stations for repair without first placing a substitute; and in the event of a light vessel parting her moorings, then that position be occupied without delay by a substitute.

That proper lists for the supply of each class of light-house, according to order or number of lamps, be made, and the person charged with the delivery of supplies be guided by it alone, without any discretionary power to increase, lessen, or change the quantity of articles to be on hand on a certain day.

That all articles of supplies be selected and tested by persons of professional ability and standing.

That the necessary steps be taken, without delay, to ascertain what additional aids to navigation are necessary in the bays of New York, Delaware, and Chesapeake, and their tributaries, to enable steamers and other vessels to enter them at night, and proceed direct to their destination.

That hereafter, buoys, required to be placed over newly discovered shoals, or over vessels wrecked in or near channels, or where they may endanger vessels, be placed without delay, and the expense be defrayed from the general appropriations for buoys.

That larger and better distinguished buoys be placed to mark the

channels of our principal bays and harbors, especially New York bar and bay, Delaware and Chesapeake bays, &c.

That appropriations be asked for two first-class light vessels, to be fitted up in the best manner with the most approved reflector or refractor apparatus, and with proper distinguishing characteristics; one for the South shoals off Natucket, and the other for Frying-pan shoals, off Cape Fear, to be placed in the best positions for aiding navigators, under the direction of the Superintendent of the Coast Survey.

That appropriations be asked for renovating, and for first order lens apparatus for the lights at Cape Hatteras, North Carolina; Cape Florida, Florida; Dry Tortugas, Florida; Cape Canaveral, Florida; Cape Romain, South Carolina; Fire Island inlet, New York; Cape Henlopen, Delaware; Cape Henry, Virginia; Gay Head, Massachusetts; Montauk Point, New York; and for the following new lights, to be fitted with first order lenses, viz:

One, half way between Montauk Point and Fire Island light-house, Long Island; and one between Jupiter inlet and Gilbert's bar, Florida.

That the appropriation for Flynn's Knoll light-house be changed to authorize range beacons for New York harbor.

That an appropriation be asked for a bell-beacon for Flynn's Knoll.

That, as the foregoing recommendations can only be thoroughly carried out under the orders of a properly organized bureau or board, and as it is of vital importance to the interests of commerce and navigation, and of great importance in an economical point of view, that the present light-house establishment should be improved as rapidly as possible.

To carry out these suggestions, it is further recommended:

That a light-house board be created, by authority of law, to be attached to the Treasury Department, with power to provide rules and regulations for their meetings and proceedings, and for discharging, under the superintendence of the Secretary of the Treasury, all the duties appertaining to the management, maintenance, repair, renovation, illumination, inspection, superintendence, and construction of light-houses, light vessels, beacons, buoys, and their appendages, in the United States.

That the Secretary of the Treasury, as ex-officio president, with two officers of the Navy of high rank; one officer of the Corps of Engineers of the Army; one officer of the Corps of Topographical Engineers of the Army, and two civilians, of high scientific attainments, whose services may be at the disposal of the President, as members; and an officer of the Navy, and an officer of Engineers of the Army, as secretaries, shall constitute the light-house board of the United States.

That the light-house board be authorized to appoint their chairman, to preside during the absence of the president, and perform such other duties as may be required by their rules and regulations.

That the light-house board be authorized to prepare such rules and regulations as shall be necessary for securing an efficient, uniform, and economical system of light-house administration, and for securing responsibility in the inspectors, keepers, and others connected with the light-house service, subject to the approval of the Secretary of the Treasury, and which, when approved, shall be respected and obeyed, until altered or revoked by the same authority.

That the light-house board be required to meet four times a year, and subject to be convened by the Secretary of the Treasury, whenever, in his judgment, it may be necessary for the transaction of general or special business, a majority of whom shall constitute a quorum.

That such clerks as are now employed on light-house duties in the Treasury Department may be transferred to the light-house board without any increase of salaries; that the necessary accommodations for the clerks, secretaries, for the preservation of the archives, drawings, &c., &c., and for holding the meetings of the board, be provided in the Treasury Department.

That all archives, books, drawings, models, &c., &c., belonging to the light-house establishment, may be transferred to the light-house board, for their use, in the discharge of their duties.

That the President be authorized and required to appoint from the Army or Navy an inspector of lights, beacons, buoys, &c., for each light-house district, to be arranged by the board, with the approval of the Secretary of the Treasury; which inspectors shall be under the orders of the light-house board.

That the light-house board be authorized to prepare and distribute among the light-house keepers, inspectors, and others connected with the light-house establishment, such rules, regulations, and instructions, as may be necessary to secure an efficient, uniform, and economical system of administering the light-house establishment of the United States, and to secure responsibility from them.

That the light-house board be authorized and required to cause to be prepared by the engineer secretary of the Board, or by such officer of engineers of the Army, as may be detailed for that service, all plans, drawings, specifications, and estimates of cost, of all illuminating, and other apparatus, and of construction and repair of towers and buildings, &c., &c., connected with the light-house establishment; no bids or contract being accepted or entered into, except upon the decision of the Board, at a regular or special meeting, and through their properly authorized officer.

That, hereafter, all materials for the construction and repair of light-houses, light-vessels, beacons, buoys, &c., &c., shall be procured by public contracts, under such regulations as the Board may from time to time adopt, subject to the approval of the Secretary of the Treasury, and all works of construction, renovation, and repair, shall be made by the orders of the Board, under the immediate superintendence of their Engineer secretary, or of such Engineer of the Army as may be detailed for that service.

That it shall be the duty of the Light-house Board to furnish, upon the requisition of the Secretary of the Treasury, all the estimates of expense which the several branches of the light-house service may require, and such other information as may be required, to be laid before Congress at the commencement of each session.

That all acts and parts of acts, inconsistent with these recommendations, be repealed; and all acts and parts of acts relating to the light-house establishment of the United States, not inconsistent with these recommendations, and necessary to enable the light-house board, under the super-

intendence of the Secretary of the Treasury, to perform all duties relating to the management, construction, illumination, inspection, and superintendence of light-houses, light-vessels, beacons, buoys, sea-marks, and their accessories, including the procuring and testing of apparatus, supplies, and materials of all kinds for illuminating, building, and rebuilding when necessary, maintaining, and keeping in good repair the light-houses, light-vessels, buoys, beacons, and sea-marks of the United States; and the second and third sections of the act making appropriations for light-houses, light-vessels, beacons, buoys, &c., approved March 3, 1851, be declared to be in full force, and have the same effect as though the light-house Board had not been created.

That no additional salary be allowed to any civil, military, or naval officer who shall be employed on the light-house board, or who may be in any manner attached to the light-house service of the United States; and that it shall be unlawful for any member of the light-house board, inspector, light-keeper, or other person in any manner connected with the light-house service, to be engaged, either directly or indirectly, in any contract for labor, materials, or supplies for the light-house service, or to possess, either as principal or agent, any pecuniary interest in any patent, plan, or mode of construction or illumination, or in any article of supply for the light-house service.

With such a board for the care and management of our present large and daily increasing light-house establishment, composed of the best adapted materials, from civil, military, and naval life, our lights must not only rapidly improve in efficiency, but also in economy.

By the assistance of the officers, proposed as inspectors, and the two secretaries of the Board, a general and systematic plan of classification, distinction, illumination, construction, repair, inspection, and superintendence, will, in a short time, be introduced, to the great advantage of commerce and navigation, and to the economy of the service.

The engineer secretary, with the assistance of officers of engineers now authorized by law to superintend the construction and renovation of light-houses, &c., will be able to prepare plans, estimates, and specifications of proposed works of construction and repair, and give a general superintendence to the lights, beacons, and buoys along the entire coast. The board will be able, at the close of the first fiscal year after it is in operation, to make detailed returns of expense of apparatus, combustibles, &c., &c., exhibiting at one view the actual annual expense of every light on the entire coast; examine into the best modes of construction for special positions, make necessary experiments upon apparatus, oils, gases, &c., &c., for light house purposes; and determine, from information derived from their own and other competent officers, what increased aids are necessary along the coast to recommend to Congress.

They would in a short time be able to furnish to navigators clear and full descriptive lists of the lights, beacons, buoys, sea-marks, &c., with such notices of them as may be necessary to guide them in making our coast in tempestuous weather, and which could be reprinted at short intervals of time, if necessary, to point out new structures or changes.

The Coast Survey Charts would then be furnished with an account of every change of position or character of lights, buoys, beacons, &c.,

&c., which would enhance their present great value to the navigating community.

Under an efficient organization, such as the proposed, the duty would be performed better and more economically than at present, and there would be great saving in the end, by affording to Congress estimates for proposed new works, rejecting works not considered necessary, and by introducing a class of structures which would require much less annual expense for repair than those now existing.

The ablest engineers of the Army would be called upon to decide upon plans for structures in cases involving doubts; the best and most durable illuminating apparatus would either be imported or fabricated in this country under the immediate eye of the officers of the Board, and when ready, be placed properly in the lanterns by the engineer charged with the work.

Boards for the execution of important duties are not novelties even in this country. Some, and indeed nearly all, of the most important undertakings which this Government has ever embarked in, have been planned and executed under the general supervision and management of boards. They are found in nearly every branch of our civil and military institutions; of every name, and for almost every purpose. They have been successfully tried for this special purpose in France, where the Savans of the Academy of Sciences, without fee or reward, sit side by side with the Minister of State, the officer of the Navy, and the Engineer; in England, the Duke of Wellington presides, while the Prince, the Peer, the Admiral, the Commoner, and the retired Sea Captain, sit together and devise means for alleviating the hardships and lessening the dangers of the mariner in approaching their dangerous coast.

In Scotland this important branch of service is under the management of a board composed of the Sheriffs of the counties, lawyers, and other civilians, who meet four times a year, without any remuneration, to transact business connected with the lights of Scotland.

In addition to these meetings, there are numerous standing committees; some of which meet as often as once a fortnight for the transaction of business, which is reported to the general meetings for their sanction and approval. There is attached to this board a secretary and an engineer, who is the executive officer, upon whom devolves all the scientific details of construction, repairs, and illumination.

In Ireland there is also a board charged with the management of light-houses, &c., with a secretary, engineer, &c.

This board, as in Scotland, is composed chiefly of philanthropic Civilians and an English Admiral. The fact of Scotland and Ireland having no army or navy, and no distinct commercial marine, will readily account for such an organization, in which no motive, other than the praiseworthy one of doing good, could prompt individuals of standing, wealth, and distinction, to perform the drudgery of so laborious an office without pecuniary remuneration.

There is not a harbor in England, of any note, that has not its "Trinity Board," or "Board of Trustees," charged with the lights, beacons, and buoys; such, for example, as Liverpool, Newcastle-upon-Tyne, Hull, &c., &c., under all of which the lights are managed in a manner worthy

of the highest commendation, both for efficiency and economy. (Vide letter of Wm. Lord, Esq., Surveyor of the Port of Liverpool, and returns of local corporations, appendix.)

It is thus seen that the best managed lights of Europe are under the management and direction of boards, with proper officers to assist them in their duties. That this service should be deemed sufficiently honorable in France, Scotland, &c., to be performed gratuitously, is not so much to be wondered at, when we recollect the high standard of excellence it has reached through the instrumentality of the philanthropic individuals constituting those light-house boards.

In concluding this part of their report, the board consider it their duty to urge upon Congress the necessity for a change in the present management of our light-house establishment.

In investigating the subjects confided to them, they have endeavored to reach the truth from observation and research. That they have not done injustice to any one, they feel perfectly conscious; to have passed over palpable defects in the present management of our lights, involving great loss of human life and property, without pointing them out, would have been culpable and unpardonable; and that they have looked as leniently as possible on many points considered exceptionable, it is believed will be clearly shown by their report.

The board have not sought so much to discover defects and point them out, as to show the necessity for a better system. Commerce and navigation, in which every citizen of this nation is interested, either directly or indirectly, claim it; the weather-beaten sailor asks it, and humanity demands it.

On the Alluvial Formations and the Local Changes of the South-Eastern Coast of England. First Section, from the River Thames to Beachy Head. By J. B. REDMAN.*

The paper stated, that the passage of shingle along the English coast, due, as was generally believed, to the action of waves alone, took on the south coast a course from west to east, and on the east a course from north to south; during certain winds the shingle was heaped up coincident with their direction, and repeated withdrawals and renewals (the latter being the most frequent) caused a leeward movement of the material, forming it, at the same time, into a series of triangles, of which the shore was the base. If any natural or artificial projection interrupted this motion, an accumulation, which would increase and be held in check according to the state of the wind, took place up to a certain point, or until the angle formed was filled up, when the shingle would pass round. With groynes, by far the most common action was, unless they were of great height, or short length, for the shingle, after accumulating on the weather side to the level of the top of the groyne, to pass over it, and then travel to leeward.

The degradation of the north shore of Kent, the local formation of shingle around the Isle of Thanet, by the wasting away of that chalky

* From the London Athenæum, December, 1851.

promontory, and the retention of large masses of alluvial matter in Pegwell Bay, were dwelt on. The main belt of shingle lying to the south of Deal, and extending from thence to Dover, with its early and present effects on the harbor at the latter place, were then described; also, the early condition of Folkstone Harbor, the large accumulation of shingle arrested to the westward of that haven, by the projection of a low-water pier, or groyne, at right angles to the harbor, and its effect upon the shore to the eastward, by retarding the progressive motion of the shingle in that direction. Further on, the curious formation at Dungeness Point, which it was reasonable to suppose did not at one time exist, as the parallel "fulls" of beach between Romney and Lydd, and extending from Winchelsea on the west to Hythe on the east, seemed formerly to have constituted the sea coast. The rectangular "full," running from the banks on the west side of Lydd towards the point, might have been created by an accumulation of shingle traveling from the westward, held in check by the outfall of the river Rother; the angle contained by this spit and the coast to the westward becoming gradually filled up with shingle, a silty deposit would take place on the east side, consequent on the gradual loss of Romney Harbor, and the length of the spit would be increased by the parallel ridges of shingle periodically added to, and traveling round it. Numerous examples, extending over two centuries, showed that the average annual increase was six yards, reaching, over certain periods, an average of eight yards per annum, the absolute increase since the time of Elizabeth being nearly one mile; and they proved conclusively, that the average progress seaward, producing a determinate aggregate elongation in a south-easterly direction, was much greater than had been generally assumed, though not regular, for the Ness had even been stationary during certain periods.

The gradual decadence of the ancient ports of Hythe, Romney, and Lydd, to leeward of this Point, was then alluded to; as also, the diversion of the outfall of the river Rother to Rye, once an estuary of the sea, and then forming Romney Harbor; the great increase of shingle to the westward; the early and abortive attempts to form a harbor at Hastings; the vast abrasion of the coast along Pevensey Bay, the harbor of which place had been lost by the elongation and extension of Langley Point. Between the origin of this Point and that of Dungeness, there was a remarkable similarity, both having originally had a tidal haven to the leeward, eventually choked up by the elongation of these spits across their outfalls; both had pools, or meres, arising from the land-locked waters, and in both cases the modern "fulls" of shingle could be plainly distinguished from the more ancient, by their forms and direction. The remarkable decrease of this point, about three-eighths of a mile, during the last century, appeared to arise principally from Old Brighton Beach no longer affording the necessary supply of shingle.

The early condition and present state of Cuckmere and Newhaven Harbors, the great degradation of the coast at Rottingdean, the sweeping away during Elizabeth's reign of the beach and town of Old Brighton, then standing on the site of the present Chain-pier, the materials from which formed the spits to the eastward, were described.—*Proc. Inst. Civ. Eng., December,* 1851.

AMERICAN PATENTS.

List of American Patents which issued from March 2d to March 30th, 1852, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Life Preservers;* Stephen Albro, Buffalo, New York, March 2.

Claim.—"I claim as my invention the sectional berth-bottoms, as represented by figs. 2 and 3, and as minutely described,"

2. For an *Improved Arrangement of Steam Boilers;* William Barnhill, Pittsburg, Pennsylvania, March 2.

Claim.—"I am aware that it is not new to locate a cylindrical water vessel in the flue of a boiler; and also, that such vessel sometimes contained flues; but these flues were in this instance direct flues, and the fire box was placed outside of the boiler proper.

"What I claim, therefore, as my invention is, the arrangement of the cylindrical boiler having return flues therein, within the flue of the main boiler, in such manner that the front end of said cylindrical vessel extends over the fire grates, and so that nearly its whole outer surface is exposed to the action of the flames, gases, &c., which, after their passage through the annular flue, proceeds to the chimney, through the small flues in such cylindrical vessel."

3. For an *Improvement in Grain Dryers;* Henry G. Bulkley, Kalamazoo, Michigan, March 2.

"The nature of my invention consists in constructing a cheap apparatus, to make so much steam only as is necessary to keep the materials to be kiln-dried from scorching, and in using the escape heat to keep up the temperature of the steam thus made for kiln-drying rapidly."

Claim.—"What I claim as my invention is, so arranging an open steam or pan, in connexion with the fire chamber and steam chamber, and flues for the escape of heat, that the steam shall rise freely into the steam chamber, and the heat kept up by contact with the escape flues, as herein described, for the purpose of producing a high degree of heat, yet not so high as to injure the grain or other materials to be dried by its agency."

4. For *Improvements in Omnibus Registers;* F. O. Deschamps, Philadelphia, Pennsylvania, March 2.

Claim.—"What I claim as my invention is, the use of the ratchet wheel, E, and its pawl, or their equivalents, for the purpose, substantially as herein set forth, of preventing the possibility of giving a blow to the hammer, by means of a recoil of the wheel, B.

"I also claim the combination, substantially as herein described, of the toothed wheel, G, to which the dial plate, A^2, is affixed, with the notched cylinder, I, and click, H, whereby the dial plate, A^1, for registering the concealed dial plate, A^2, 24, or any number of fares marked on the dial plates, A and A^1, substantially as herein set forth."

5. For an *Improvement in Chairs;* George O. Donnell, New London, New York, March 2.

"The nature of my invention consists in a metallic ferrule, ball, and foot piece, combined and applied to the back posts of a chair, in such a manner as to let the chair take its natural motion of rocking backwards and forwards, while the metallic foot piece rests unmoved, flat, and square, on the floor or carpet."

Claim.—"What I claim as my invention is, the construction and application of a metallic combination to the lock posts of chairs, so as to let the chairs take their natural motion of rocking backwards and forwards, while the metallic feet rest unmoved, flat and square, on the floor or carpet, or any other metallic affixion substantially the same, and which will produce the intended motion."

6. For an *Improvement in Cast Iron Car Wheels;* Orson Moulton, Blackstone, Massachusetts, March 2.

"This invention consists in connecting the hub and rim by two curved plates, having raised or projecting ribs running in cyma form on their inner sides, from the hub to the rim, and across the inside of the rim, the ribs on each side being placed opposite the middle of the space between those on the opposite side."

Claim.—"What I claim as my invention is, connecting the hub and rim of railroad wheels by curved parts, A A, having raised or projecting ribs, *a a*, and *b b*, of cyma form, on their inner sides, extending also across the inside of the rim, the said rims on each plate being placed opposite the middle of the spaces between those on the opposite plate, and each rib terminating in the opposite plate to that on which it stands."

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7. For *Improvements in Knitting Looms;* William Henson, Newark, New Jersey, March 2.

Claim.—"Having now described the construction and operation of my improved knitting loom, I disclaim the invention of warp machines; also, the invention of needles, guides, sinkers, presser and actuating cams, or cut wheels, for racking the guide bar, the same having been used prior to my invention.

"But what I do claim is, 1st, the relative motions of the needles, hooks, and presser, as combined, to form the looped or knitted fabric, in combination with the stops or guards on the hook bar, to prevent the presser from coming in contact with the hooks; the whole being constructed and arranged substantially as herein set forth.

"2d, I claim the combination of mechanism for regulating the take-up motion according to the quantity of fabric formed, without varying the tension of the fabric, substantially as described."

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8. For an *Improvement in Cotton Presses;* Lewis Lewis, Vicksburg, Mississippi, March 2.

Claim.—"What I claim as my invention is, the arrangement herein described, of a vertical revolving press, with toggle joint, operated by the toothed racks and fixed pinions, substantially as herein set forth."

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9. For *Improvements in the Plates of Trunk Locks;* Conrad Liebrich, Philadelphia, Pennsylvania, March 2.

Claim.—"Having thus described the nature of my invention and the manner in which it is constructed, what I claim as new is, the guard constructed and applied as described, by which the lock is prevented from being wrenched or torn off from the article to which it is attached, and by which the hasp is prevented from being pryed or twisted, so as to be freed from the bolt; thus obviating the necessity of the ordinary back plate, substantially as set forth."

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10. For an *Improvement in Blasting Rocks under Water;* Benjamin Maillefert, City of New York, March 2.

Claim.—"What I claim as my invention or discovery is, the blasting of rocks under water, by placing the explosive charge or charges on or against the surface of the rock to be blasted, and using the surrounding water as the means of resistance to the explosion, substantially as herein specified."

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11. For *Improvements in Cast Iron Car Wheels;* Hiram W. Moore, Bridgeport, Connecticut, March 2.

"The nature and object of my invention and improvement consists in constructing cast iron car wheels for railroad cars, in such a manner and form as to prevent their fracture and cracking, by the unequal contraction of the metal composing them, while consolidating at the time of their manufacture; the unequal shrinking of the different parts being the greatest difficulty to overcome in casting perfect wheels."

Claim.—"What I claim as my improvement in railroad car wheels is, the concave rings formed and located as described, in combination with the spokes or braces in the

exterior ring, and the concavo-convex plate or partition, arranged and combined substantially as herein set forth."

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12. For an *Improvement in Machines for Printing Floor Cloths;* Simeon Savage, Lowell, Massachusetts, March 2.

Claim.—"What I claim as my invention is, the arrangement of the printing mechanism, the stamping down mechanism, and the mechanism for advancing the piece or strip of cloth or of material to be printed and pressed, or stamped; such arrangement being as exhibited in the drawings and as above described.

"And I also claim the combination of the lip bar or plate, *y*, the series of bent levers, *a' a'*, &c., the slide bar, R' or S, and the bar, *c'*, as made and operated substantially in manner and for the purpose of seizing the selvedge edge of the cloth, and moving the piece as described.

"And I also claim the combination of mechanism for operating the coloring carriage, or imparting to it its back and forth movements and necessary intervals of rest; the said combination consisting of the rotating shaft, O, with its circular disks, Q R, and their projections, *i k*, the four hook bars, *l l p p*, together with the vibrating bars, *n o*, as applied together and operated substantially as specified."

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13. For an *Improvement in Endless Chain Horse Powers;* Theodore Sharp, Albany, New York, March 2.

"The nature of my invention consists in constructing the endless chain of curved links, with teeth on the outer edge, which give motion to pinions at or over the one end, the said curved links, on their inner edge, fitting on and corresponding with the peripheries of drums or pullies, at either end, so that the carrying rollers are allowed to move in space, while traveling the ends where a change of motion occurs, and much friction is necessarily avoided."

Claim.—"Having thus described my invention, I do not claim constructing the endless chains of horse powers, with curved or bent links, the under surface of which corresponds to the surface of the revolving drums which support them, as that has been done before; but what I do claim as my invention is, the combination of the bent links *a a*, the revolving drums B, and the pinions D, constructed and operating in the manner and for the purpose substantially as described."

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14. For an *Improvement in Bridging Navigable Streams;* Benjamin F. Lee, City of New York, March 2.

"The nature of my invention consists in a new combination of bridge, canal, tunnel, and road, by means of which, neither the passage of carriages, or cars, across rivers, nor the passage of vessels up and down them, is impeded for an instant, draw bridges by this invention being rendered unnecessary."

Claim.—"What I claim as my invention is, the combination of canal A, tunnel B, bridge and road, constructed and arranged substantially as above described."

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15. For an *Improvement in Friction Clutches;* Gerard Sickels, Brooklyn, New York, March 2.

Claim.—"What I claim as new is, 1st, the arrangement of the levers C, and arms *d* d^1, for operating the segments E, E, substantially as shown and described, by which arrangement the segments are made to bind in the V collar F, or be relieved from it, as desired; the segments, when bound in the collar, remaining in that state, the points or pivots *e e*, having passed the line of pressure, unless acted upon by some extraneous force, as the moving of the vibrating slide G.

"2d, I claim, in combination with the arrangement of levers and arms, the V collar E, and segments E E, said segments being adjusted by screw rods *h*, and nuts *i*, as set forth."

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16. For an *Improved Encircling Suspender for Garments;* Harris H. Tinker, New London, Connecticut, March 2.

Claim.—"What I claim as my invention is, the combination of the spring or belt, *a*,

with the straps, *h h*, and the circular pads, *k*, fig. 7, for the purpose of sustaining garments upon the human body, arranged substantially as set forth in the above specification."

17. For an *Improvement in Brick Machines;* Samuel L. Speissegger, Savannah, Georgia, March 2.

Claim.—"What I claim as my invention is, the employment of the plate, L, of the traveling mould table, operating simultaneously on the rods, *d d*, and pistons, *c c*, in the moulds, *b b*, in combination with the pressing plate, N, of a steam or other press, for the formation and delivery of brick, as substantially set forth."

18. For an *Improvement in Camphine Lamps;* Isaac Van Bunschoten, City of New York, March 2.

Claim.—"I am aware that a lamp has been made with a flanch or short pipe inside the wick tube, to enter inside the air tube, to prevent the resinous matter formed in burning, sticking the wick and air tube together; but I am not aware of packing ever having been employed at this point. Therefore, what I claim is, 1st, the application of a suitable elastic packing between the wick tube, and air tube, attached in any convenient manner, in camphine lamps, for the purposes and as described and shown.

"2d, I claim the application of a suitable ring or chamber around the wick tube, to receive or conduct water or other fluid to the wick, so that the light is extinguished in case of accident, as described and shown."

19. For an *Improvement in Compasses for Determining Variation from Local Causes;* John R. St. John, City of New York, Assignor to the St. John's Compass and Log Company, March 2; patented in England, December 27, 1851.

Claim.—"I do not claim the invention of a new mariner's or surveyor's compass, because these improvements can, in most instances, be added to compasses already in use; but I do claim as new and of my own discovery, or invention and improvements, the application of satellite or auxiliary needles to the magnetic compass, such needles being prepared, applied, and adjusted in the manner and for the purposes as herein set forth, including any merely mechanical variations that shall be actual equivalents of the means employed, as described and shown herein, and substantially the same as applied by me for the purposes herein set forth."

20. For *Improvements in Flour Bolts;* Samuel Cook, Adams' Basin, New York, March 9.

"The nature of my invention consists in so arranging a bolting machine, as that it shall perform all the functions of cooling, bolting, and bran-dusting, in one continuous operation, and thus avoid the necessity of three distinct and separate machines, and merely occupy the space usually allotted to the most compact bolting machines."

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with a series of graduated stationary bolting disks in separate chambers, the rotating brushes placed above said disks, and the sweeps in a chamber below them, for the purpose of separating the bran, first and second middlings, and the flour, and conveying the meal, &c., through the machine, and for avoiding the use of a bran duster; the whole being arranged in the manner and for the purpose herein fully set forth."

21. For an *Improvement in the Water Gauge of Boilers, &c.;* Benjamin Crawford, Allegheny City, Pennsylvania, March 9.

Claim.—"What I claim as my invention is, the arrangement of the glass index tube, below the point at which the float chamber is connected with the water in the boiler, the water tube connecting with the boiler, at some distance from the bottom of the latter, so that it is not liable to become obstructed, which renders the indications of the float certain, while the coolness and quietness of the water in the index tube leaves it transparent, so that the index can be seen clearly and conspicuously."

22. For an *Improvement in Corn Shellers;* William Linsley, Township of Waddam, Illinois, March 9.

"The object of my invention is to shell ears of corn of varying size and shape; and it consists of stationary sectional spring shelling plates, with a rotating sectional spring shelling disk; the two acting in such manner that they yield to thick ears of corn, or to the thick part of an ear, and thus shell off the grain, without breaking up the cob, while they close upon small ears, or upon the small end of a thick ear, and insure the separation of the grain from the cob, whatever may be its size and proportions."

Claim.—"What I claim as my invention is, the combination of stationary sectional spring shelling plates, with a rotating sectional spring shelling disk, substantially in the manner herein set forth, the plates and disks having a wabbling or universal motion, caused by the constant varying of the space between them, to accommodate itself at the same time to ears of varying size and shape, by which means the cobs are less broken and more thoroughly stripped than in machines as heretofore constructed, for shelling corn fed into them promiscuously and in mass."

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23. For *Improvements in Canal Lock Gates;* Charles Neer, Troy, New York, March 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, 1st, The opening of the lower gates of a canal or river lock outwards or down stre m, in combination with the means described, or their equivalents, for operating them, for the double purpose of saving length in the lock chamber with the same walls, and for allowing the gates to be opened before the chamber is entirely empty, so that the escaping water may carry out with it the boat, raft, or other thing, being passed through with the least possible delay.

"2d, I claim the stationary gate at the head of the lock which forms, with the breast wall of the lock, with the top of which it is level, a recess or chamber, through which the lock chamber may be filled at any desired height above the bottom of the lock, and thus save length of lock wall.

"3d, I claim, in combination with the stationary gate, the sinking head gate, extending across the lock, and reaching down a little below the top of the stationary gate, when the gate is shut, and which sinks or slides into the recess formed in part by said stationary gate, and is on a level therewith, when open, for passing boats, &c., for the purpose of saving in the length of the lock chamber, an amount nearly equal to the width of the gate.

"4th, I claim the so placing of an adjustable bottom or water strip on the bottom of a lock, as that it may be operated upon by the pressure of the water within the lock chamber, and be forced up against the gate, when prevented from being closed tight by an intervening substance, substantially in the manner herein set forth and described."

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24. For an *Improvement in Seed Planters;* Ira Reynolds, Republic, Ohio, March 9.

"The nature of my invention consists in a peculiar form of grain cylinder and box, for conducting the grain into the teeth of the machine; also, the arrangement of a multiplying wheel or hub upon each end of the axle tree, for regulating the quantity of grain desired to be sown; also, the general arrangement of the several parts, to effect these ends."

Claim.—"I am aware, however, that driving wheels have been attached to the ends of the axle tree, for the purpose of driving grain cylinders, and do not wish or intend to claim as new the arrangement of driving wheels, abstractly considered, on each or either end of the axle tree, as mere driving wheels. But what I do claim as my invention is, the peculiarly formed curved lips or feeders, and longitudinal grooves or channels, so constructed and tightly fitted to the cast box, L, as to prevent any grain from passing into the chamber, except what is forced through the grooves by the lips or feeders, substantially as set forth."

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25. For an *Improvement in Hay Rakes;* Jay S. Sturges, Litchfield, Ohio, March 9.

Claim.—"I disclaim suspending the head, so that each tooth acts separately, and the platform, L. What I claim as my improvement is, 1st, The arms projecting from the axle, in combination with the joint, F, for the purpose of adjusting the position of the teeth to the surface of rough or smooth land.

"2d, Hanging the arms to the axle by means of the standard, I, and connecting rod, and also raising and lowering the arms as the teeth may require, by means of the pin and holes in the connecting rod and arms at J."

26. For an *Improvement in Melodeons;* A. L. Swan, Cherry Valley, New York, March 9.

Claim.—"What I now claim as my invention is, 1st, constructing the air receiving box of a melodeon, or other keyed wind instrument of a similar nature, which is operated by an exhausting bellows or pump, with a vibrating or movable top, connected to it by wings or joints, which fold or bend, substantially in the manner described, towards the external air which acts upon them, whereby the external air, acting upon the said wings, counteracts the inequality of the force exerted by the spring placed inside, to open or expand and enlarge the interior capacity of the box.

"2d, The manner of hanging the treadle, L, for operating the bellows, upon the two vibrating rods, M and M, attached to the floor, or to any object under the instrument, substantially as herein set forth."

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27. For an *Improvement in Iron Fences;* John B. Wickersham, City of New York, March 9.

"The nature of my invention consists in so forming the mortises and loops upon the posts and rails of iron or other metallic fences, and the putting of the same together, as that they shall form a solid, firm fence, without the use of keys, bolts, wedges, or any other fastenings than those afforded by the shapes of said mortises and loops, and using for this purpose but single posts in each panel thereof."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so constructing the loops and mortises in the rails and posts of iron fences, as that when in place neither of them can be removed, using for this purpose single posts and rails, and neither bolts, wedges, keys, or any other fastening, except what is afforded by the peculiar shape of the said loops and mortises; and this I claim, whether the same be constructed as herein described, or by any other means essentially the same."

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28. For an *Improvement in Ploughs;* Joshua Woodward, Haverhill, New Hampshire, March 9.

Claim.—"Having thus fully described my weeding plough, what I claim therein as new is, the plate constructed, arranged, and combined with the plough, substantially in the manner and for the purpose set forth."

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29. For an *Improvement in the Manufacture of Door Knobs;* Benjamin Nott, Bethlehem, Assignor to John P. Pepper, Albany, New York, March 9.

Claim.—"I claim, substantially as set forth in the above specification, in the manufacture of vitreous metal knobs and similar articles, 1st, The application and use of a metal plug, to be entered into the socket and fitting it, the plug passing up from or through the bottom of the mould, for the purpose of preventing the melted material from filling the socket during the pressing operations, and at the same time facilitating the centreing and adjustment of the socket.

"2d, I claim the invention of, and substitution in the place of pincers and polishing rods heretofore known, a polishing rod capable of polishing several knobs simultaneously and by one operation, substantially as above described."

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30. For *Improvements in Double Plane Irons;* Fordyce Beals, Pittsfield, Massachusetts, March 16.

Claim.—"I disclaim all contrivances, arrangements, or forms of cap or iron, which together compose a double iron, now in general use. What I claim as my invention is, the new and improved mode of fastening and adjusting the cap to the iron, by means of a projection and slot, forming a dove-tail slide, giving new facilities for the operation, and also a level surface to the back of the iron; also, the elongation of part of the width of the cap, and its occupying the place of a removed part of iron, giving the operator new facilities in nicely adjusting cap to edge of iron, without removing it from the stock, the same as herein described, using for the purpose the aforesaid arrangements of parts, or any other substantially the same, and which will produce the same effect in like manner."

31. For an *Improved Pressure Gauge;* Benjamin Crawford, Allegheny City, Pennsylvania, March 16.

Claim.—"What I claim as my invention is, a closed pressure gauge, constructed substantially as herein described, so that equal increments of pressure will cause the indicating liquid to rise in the tube equal linear distances, or thereabouts, in combination with an adjustable scale to indicate the degree of pressure, and a standard weight and blow-off valve, by which the scale can, from time to time, be adjusted, so as to give true indications of the pressure of the steam, substantially as herein set forth."

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32. For an *Improvement in Carpets;* Thomas Crossley, Roxbury, Massachusetts, March 16.

Claim.—"I lay no claim to the invention of making a carpet by the process of plying and ingraining, or connecting together, the plys or different layers of cloth, whether woven either with plain (or uncolored) or colored yarns; nor do I claim the process of producing figures by printing them in colors; nor do I claim to weave a carpet with an uncolored pile or warp in the Brussels process of weaving, and afterwards printing the figures thereon in colors: but what I do claim as my invention, or new or improved manufacture, is, an ingrained, plyed printed carpet, made by a combination of the process of weaving in two or more plys, and ingraining the same, and subsequently printing the figure or figures on both sides of the same, as described; the discovery having been made by me, that the plying process prevents the colors printed on one ply from penetrating the other ply, so as practically to injure its other surface, to an extent which renders it unfit for the reception of colors and use as a carpet, as herein before stated, a great improvement in trade being the result of such."

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33. For an *Improvement in the Construction of Grate Bars;* Frederick P. Dimpfel, Philadelphia, Pennsylvania, March 16.

"The nature of my invention consists in constructing grate bars for furnaces of clay, soapstone, or other refractory substance, enclosed in a metallic casing, or sustained by a metallic frame, when such is required."

Claim.—"I am aware that grate bars have been, heretofore, so constructed of metal, that the loose ashes of the furnace might accumulate in cavities therein, and protect the bar; but these have been found inefficient in practice, as any loose substance merely accumulating in the cavity of a metallic grate bar, will shake off even with the edges thereof, and thus expose the bar to the action of the fire. I do not, therefore, wish to be understood to claim any particular form of grate bar, the above described frame being one of easy construction and adaptation to the purpose; but any other suitable form may be given to this frame, which the nature of the refractory substance may render preferable. What I claim as my invention is, the construction of grate bars for furnaces of clay, soapstone, or other refractory substance, for the purpose and in the manner herein specified."

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34. For an *Improvement in Sofa Bedsteads;* John T. Hammitt, Philadelphia, Pennsylvania, March 16.

"My improvements are comprised in the combination of certain conveniences for the toilet and other purposes, necessary to a bed-chamber, all contained within the dimensions of a sofa when put up, and yet to be easily drawn out and arranged for service."

Claim.—"Having thus fully described my improved sofa bedstead, what I claim therein as new is, 1st, the combining the back of the sofa with the seat, by means of sliding pivots, in the manner and for the purpose set forth.

"I also claim the sliding table and wash-stand, in combination with the sofa, substantially in the manner and for the purpose set forth."

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35. For an *Improvement in Joints around Tubes for Philosophical Apparatus;* A. B. Latta, Cincinnati, March 16.

Claim.—"I claim the method used for promoting the drying or evaporating of the liquid matter from the packing, by drilling the holes 1, 1, 2, 2, and 3, 3, in the barrel, the said holes being afterwards filled with solder.

"I claim the method of making the joint at the end of the tube, which is effected by the friction of the packing around the tube, which forces the end of the tube against the bottom of the bore, and produces a joint, when the stuffing box is forced to its place, as herein mentioned and set forth."

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36. For an *Improvement in Shovel Ploughs;* James Lattimer, Chattoogaville, Georgia, March 16.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the combination of the wing, or half shovel plough, and the adjustable scraper, arranged on different stocks in the said beam, when the said scraper is arranged on the land side and rearward of the plough, and so that the grass, weeds, &c., shoved off by the scraper, will be thrown into the furrow made by the plough, the whole being arranged in the manner and specially for the purpose herein set forth and fully shown."

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37. For an *Improvement in Cotton Gins;* Thomas J. Laws, Washington, Arkansas, March 16.

"The nature of my invention consists in the combination of an additional brush wheel, with the saws, and the stripping brush, of the ordinarily constructed cotton gin, in such a manner as to cause the said additional brush wheel to remove the motes from the cotton, while it is upon the teeth of the saws, by acting against the front sides of the said saw teeth, just before the cotton is stripped therefrom."

Claim.—"I do not claim the use of a mote brush, in combination with gin saws and the ordinary stripping brush, as I am aware that a cylindrical mote brush, revolving in the same direction with mine, has been used before; but what I do claim as new is, making the mote brush, (revolving in the direction described,) with wings, so as to act by a current of air, as well as by contact with the cotton on the teeth of the saws, substantially as herein set forth, in combination with the saws and grate."

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38. For an *Improvement in the Treatment of Hydro-Sulphurets, and in Manufacturing Carbonates and Sulphur Compounds;* Charles Lennig, Philadelphia, Pennsylvania, March 16.

Claim.—"What I claim as my invention is, the manufacture of carbonate of barytes and strontiæ, by processes as above described, and in combination therewith, employing the sulphuretted hydrogen gas, evolved in the aforesaid process, for the producing of sulphur, or sulphuric acid."

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39. For an *Improvement in Burners for Argand Lamps;* Austin Olcott, Rochester, New York, March 16.

Claim.—"What I claim as my invention in the within described lamp is, arranging the grooved tube for adjusting the wick inside of the wick and outside of the screw, that is, between the wick and the screw, and extending the pin from the wick holder, through the groove in the tube, into the score between the threads of the screw; thereby dispensing with the perforated tube heretofore used upon the outside of the wick, and leaving the wick open on the outside, so that the material to be burned may have free and unobstructed access around the wick."

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40. For an *Improvement in Machines for Cutting Screws on Rails and Posts of Bedsteads;* J. Parsons Owen, Norwalk, Ohio, March 16.

Claim.—I do not claim, of themselves only, reversible cutter heads, as such, or equivalent arrangements, have long been used, such as reversible cylinders and similar devices; but what I do claim as my invention is, constructing the reversible cutter heads E and F, of arms placed at right angles to one another, and carrying reverse right and left hand cutters *i i*, and *k k*, in combination with the eccentric snug *g*, and flanch *f*, of the screw spindle C, for the purposes and advantages specified, all being constructed and operating as shown and described."

41. For an *Improvement in Connecting Washers with Spindles in Spinning Machinery;* Horace T. Robbins, Lowell, Massachusetts, March 16.

Claim.—"I do not intend to confine my invention to the application of the spring, clasp, or holder, *a*, to the countersunk button, as the same holder may be used with a flat bottom, by having the bobbin countersunk, so as to let the bobbin down over the spring, clasp, or holder, such in fact constituting the peculiar essence of my invention. I therefore claim as my invention, the spring, clasp, or holder, *a*, or its equivalent, either with or without teeth, in combination with the spindle, or as applied and used therewith, substantially in the manner and for the purpose of holding the washer, as specified."

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42. For an *Improvement in Planing Machines;* Daniel Stearns, Rome, New York, March 16.

Claim.—"What I claim as my invention is, constructing, arranging, and operating a reciprocating plane, which cuts off the shaving by its forward stroke, and feeds the board by its backward stroke, and the clamps and gripes, or stops, with which such a plane is connected, as herein described, so that the board is fed at the back stroke of the plane, and planed at its forward stroke, a distance equal, or thereabouts, to the throw or stroke of the plane, whereby a greater length is planed by a given number of strokes of the plane, than in reciprocating planes that feed themselves by their own motion, as heretofore constructed; and also, the injurious shocks and strains are avoided, which in those planes are caused by the necessity of making the cut considerably shorter than the stroke."

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43. For an *Improvement in Cupping and Breast Glasses;* William S. Thomas, Norwich, New York, March 16.

"My invention consists in connecting the piston of an exhausting apparatus with the barrel thereof, by means of an elastic tube, which not only packs the piston, but also acts as a spring to draw the piston towards that end of the barrel to which the elastic tube is made fast."

Claim.—"What I claim as my invention is, the improved exhausting apparatus herein described, for surgical and other purposes; said apparatus consisting of a combination of a tubular spring piston with a barrel, substantially as herein set forth."

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44. For an *Improvement in Pattern Cards for Jacquard Looms;* Samuel T. Thomas, Lowell, and Edward Everett, Lawrence, Massachusetts, March 16.

"The object of our invention is to facilitate the operation of changing the figure or pattern of cloth that is woven upon a jacquard loom, and to reduce the expense now incurred in changing and perforating the common pasteboard cards."

Claim.—"What we claim is, the combination of the buttons with the metallic card, as described, the buttons being so riveted or attached to the card as to allow of their being turned, for the purpose of closing or opening the holes to which they are respectively attached."

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45. For an *Improvement in Hot Air Registers;* William Turton, Bushwick, New York, March 16.

Claim.—"What I claim is, the crown wheel or section of a crown wheel, in combination with the pinion wheel or section of wheel, attached to the fans as set forth."

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46. For *Improvements in Railroad Car Brakes;* Thomas Walber, City of New York, March 16.

Claim.—"1st, I claim the arrangement of the followers, 3, 4, 5, and 6, with their brake blocks, 8, rods, *e* and *f*, and links, 9 and 10, whereby the power operating to separate the followers, 4 and 5, throws the brake blocks, 8, on to each side of each wheel, for the purposes and as described and shown.

"2d, I claim the steam piston and rod, *i*, wedge, *k*, and nut, *n*, and screw, *o*, in combination with the brakes, 3, 4, 5, and 6, arranged and acting as described, whereby the said brakes can be actuated by steam from the locomotive or by hand, as described."

47. For an *Improvement in Instruments for Inhaling Powders;* Ira Warren, Boston, Massachusetts, March 16.

"My instrument, or powder inhaler, is designed for the purpose of inhaling medicine into the throat and lungs, and at the same time to prevent any of the said medicine from lodging in the mouth."

Claim.—"Having thus described my powder inhaler, what I claim as my invention is, the instrument above described, for inhaling powder, &c., into the throat and lungs; the said instrument consisting of a receiver, with holes in its bulb or end, covered by and working loosely in an exterior tube, which prevents any of the medicine from lodging in the mouth, substantially as above described."

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48. For an *Improvement in Hinges for Stove Doors, &c.;* Charles J. Woolson, Cleveland, Ohio, March 16.

Claim.—"What I claim as my invention is, the connecting and hanging of the door or doors upon the fronts of stoves or grates, so that they may be opened or closed, without marring the beauty or affecting the convenience of the same, in either case, or exposing to view the hinges or inside of the door, as described."

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49. For an *Improved Arrangement of Jack Chain Machinery;* Hickford Marshall and Seth S. Cook, Assignors to John Bostwick, Jr., and Elbert White, Stamford, Connecticut, March 16.

Claim.—"What we claim as our invention is, the arrangement on the bed plate, A, of the nipping jaw, G, the mandrel, E, and pin, F, with the turning lever, K, furnished with pin, *f*, moving under the table, B, in the manner and for the purpose substantially as set forth and shown."

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50. For an *Improvement in Omnibus Steps;* Josiah Ashenfelder, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in an inclined covering or protector, immediately connected with the outside of the door, so secured thereto as to open and shut therewith, with a brush or broom secured to the bottom of the covering as to open and shut therewith, for the purpose of cleansing the step or steps, together with a back board, operating as a protection to the inside of the step, so as to prevent mud, &c., from being thrown upon the same."

Claim.—"What I claim as my invention is, the application of the inclined covering or protector to the outside of the omnibus door, as described, to prevent persons from standing, lying, or sitting on the steps, in combination with the brush or broom, secured to the bottom of the covering or protector, so as to open and shut therewith, for the purpose of cleansing the step or steps, each step, if more than one, requiring a brush or broom attached, together with a back board to protect the inside of the step, as described."

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51. For an *Improvement in Shop Awnings;* William H. Bakewell, City of New York, March 23.

Claim.—"Having thus fully described my invention and improvement, I wish it to be known that I do not claim the pullies, cords, cog wheels, &c.; neither do I claim the enclosing of an awning, as that has already been done in many different ways, to my knowledge. What I do claim as my invention is, the method of protecting the awning, by the construction and arrangement of the cylindrical sheathing or covering, in combination with the slat, in the manner and for the purpose herein described and fully set forth."

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52. For *Improvements in Machines for Stamping Ores;* William Ball, Chicopee, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the combination of the washing basin or contrivance, L, with the stamp rod and its bearing, so as to operate in manner and for the purpose as specified.

"I also claim the deflective plate in the entrance spout or hopper, as combined with the same, and the mortar and stamper, and used for the purpose as specified.

"I also claim the improvement in the stamp head, or the making of it with a greater stamping surface on one side of its axis of rotation than it is on the other; the same being for the purpose of preventing packing of the charge, as specified.

"I also claim the mode of applying the stamp head to the stamp rod, viz: by means of the circular arcs or curves of the sides of the universal dovetail connexion with the wedge key, as described."

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53. For an *Improvement in Ploughs;* E. Ball, Greentown, Assignor to Isaac N. McAbee, Canton, Ohio, March 23.

Claim.—"What I claim as my invention is, connecting the beam to the plough irons by means of a pivot and stay bolt, and adjustable standard; the whole being constructed and arranged as described, so that the front end of the beam can be set towards either side, or either extremity raised or lowered, without changing the height of the other, or both extremities raised simultaneously and equally, or unequally, substantially as set forth."

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54. For an *Improvement in Friction Primers for Cannon;* William Ball, Chicopee, Massachusetts, March 23.

Claim.—"I claim the combining with the discharging string and tube of the primer, a cylinder or plug of leather, or other like substance, inserted and secured in the upper end of the primer, and having the exploding string passing through it, as above set forth; the said plug or cylinder serving the purpose of a breech, to confine the charge when exploded, as a protector of the sand paper and priming, against the absorption of humidity, and as a bearing for the string to draw over when pulled."

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55. For an *Improvement in Machinery for Felting Cloth;* George G. Bishop, Norwalk, Connecticut, March 23; ante-dated September 23, 1851.

Claim.—"What I claim as my invention is, the method herein described of hardening the bat by alternate steaming and jigging, substantially as herein set forth, whereby one section of the bat is jiggered, while an adjoining section is steamed, preparatory to being jiggered.

"I also claim the process of steaming and jiggering two or more bats simultaneously, whereby much time and labor are saved, and the texture of the cloth is improved.

"I also claim constructing a machine for jiggering felt bats, in such manner that it will subject successive portions of the bats to equal amounts of jiggering, and then stop, whereby a greater uniformity of texture is secured in the cloth.

"I also claim the arrangement of the steam pipes and adjutages in the steam chamber, substantially in the manner and for the purpose herein set forth."

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56. For an *Improvement in Marine Signals;* Thomas H. Dodge, Nashua, New Hampshire, March 23.

Claim.—"What I claim as my invention is, the employment for signaling or indicating the course of a vessel, of two lights of different colors, attached to or hung in a cylinder or disk, which is capable of revolving on a fixed axis, so as to change the position of the lights; the position of either light, relatively to the other, being made to point the course in any manner, substantially as described."

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57. For *Improvements in Planing Machines;* John Howarth, Salem, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the reciprocating plane for scoring the face of the board transversely, and reducing it to an uniform thickness, arranged substantially as herein described, in a compound frame, which carries the plane back and forth across the board by a regular and positive motion, and back and forth lengthwise of the board by a motion dependent upon the reciprocal action of the board against the planes in one direction, and of springs against the frame in the opposite direction, substantially as herein set forth.

"I also claim the method of smoothing the surface of boards or other lumber, by plane irons reciprocating endwise, and operated in such manner that the tendency of one to

draw the board towards that side of the machine to which it is moving, is counteracted in whole or in part by the tendency of one or more of the others to draw the board towards the opposite side of the machine; these several counter tendencies being thus made to neutralize each other, substantially as described."

58. For an *Improvement in Swingle-Trees;* Charles Howard, Madison County, Illinois, March 23.

Claim.—"I do not claim the ring and link as my invention; but what I do claim is, the flanch, as above set forth, wrought or cast, in combination with the ring and link, for the purpose of forming attachments, substantially in the mode set forth above."

59. For *Improvements in Machines for Making Cordage;* William Joslin, Waterford, New York, March 23.

Claim.—"What I claim as my invention is, the application of the fan *j k*, in combination with the pullies *f h*, belt *g*, gears N, O, P, Q, and bobbin M, as a drag, or take-up, as above described."

60. For an *Improvement in Flour Packers;* Nathan Kinman, Lewistown, New York, March 23.

"The nature of my invention consists of a spiral cone plate, for the packing of flour, so as to give to the flour an equal density throughout the barrel, and also a friction roller clutch to work in connexion with the above mentioned spiral cone plate."

Claim.—"What I claim as my invention in the above described machine for packing flour, is the friction roller clutch, constructed and arranged in the manner and for the purpose substantially as set forth."

61. For *Improvements in Smut Machines;* Thomas H. M'Cray, Madisonville, Tennessee, March 23.

Claim.—"What I claim as my invention is, the formation of a series of corrugated recesses within the periphery of the cylindrical casing of my improved smut machine, substantially of the forms represented in the drawings, when the said cylindrical casing is combined with a rotating beater, which has its beating surfaces *a a*, &c., arranged in positions which incline obliquely to the radii of the beater, for the purpose of throwing the smut and kernels of grain into the said series of corrugated recesses, in such directions that they will, in entering and rebounding therefrom, be brought in contact with their entire surfaces, and thereby produce so great an amount of friction action as to break up the smut and white caps, and polish the kernels of grain, without breaking the same."

62. For an *Improvement in Cracker Machines;* John M'Collum, City of New York, March 23.

"The nature of my invention consists in attaching to the frame of the cracker machine, a set of springs, in such a manner as to let the bed plate rest upon them, and as the cutters are forced down to cut the dough, to yield or recede under the pressure, and thereby prevent the sudden cut of the knives on the apron, and at the same time keep them longer in contact with the apron, to take their "scraps," than would be the case if the bed plate was made permanently fast to the frame, and the knives suddenly impinged upon it, and then receded."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is the use of the bed plate resting upon or supported by springs, or other equivalent devices, so that a yielding or receding action is obtained in the bed plate, while under the pressure of the cutters, or while the cutters are pressing down, for the purposes and in principle of construction and operation, substantially as set forth."

63. For an *Improvement in Manufacturing Artificial Teeth;* William S. McIlhenny, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in the manufacture of a tooth, or teeth, into a condition ready for the furnace, by the simple process of moulding."

Claim.—"What I claim as my invention is, the formation of an artificial tooth or teeth, from spar, silex, clay, sand, glass, or any materials used for the above purpose, into a suitable condition for the finishing furnace, by the simple operation of moulding, thereby avoiding the tedious and uncertain process of enameling."

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61. For an *Improvement in Machines for Paging Books;* Stephen E. Parrish, Assignor to Edwin B. Clayton & Sons, City of New York, March 23.

"The nature of my invention consists in combining together, a series of number or letter plates, upon a cylinder or barrel, and cutting on the peripheries of the plates, a series of numbers or letters, from one to the decimal point, and by means of springs and pins, attached thereto, and holes through the plates corresponding with the number of letters on their peripheries, and a changer plate, attached to the end of the cylinder, operated by a cap plate, having a ratchet and pawl contained therein, made to count or number from 1 to 99,999, as the circumstances require."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is, 1st, the use of the type plates, having channel ways and springs in their faces, and holes in them, corresponding to the ten subdivisions of their peripheries, and their inner circumferences divided into ten equal sides, in combination with a barrel having stop pins in its circumference, for the type plates and a changing plate attached thereto, and ratchet wheel, cap plate, and pawl and bent lever, for the purpose of operating a series of number plates, the said combination of parts being entirely distinct from any known mode of producing the same result, (that is, counting,) which I lay no exclusive claim to, the principle being well known; and I therefore limit my claim to combination of parts, substantially as set forth.

"2d, I claim the use of the rod C, lever E, inking roller lever J, and arm I, in combination with the type wheel, substantially for the purposes as set forth.

"3d, I claim the use of the inking roller frame and rod attached thereto, and rotating ink plate, in combination with the lever J, slide O, and type wheel and levers operating the same, substantially for the purposes as set forth.

"4th, I claim the bed R, with guides attached thereto, in combination with the table and type wheel, substantially for the purposes as set forth."

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65. For an *Improvement in Machines for Jointing Shingles;* William Stoddard, Lowell, Massachusetts, March 23.

"My improvements consist, 1st, in the arrangement by which I am enabled to point the shingle, and plane or shave both sides at the same time, this effect being produced by planing knives, set in plane stocks, moving vertically, the operation of which will be hereinafter explained. I have also made an improvement by which the machine will cut or joint the edges of any width of shingle, the shingle itself serving to regulate the position of the jointing knives."

Claim.—"Having thus described my improvements in shingle machines, what I claim as my invention is, the arrangement of the horizontal sliding boxes, which carry the jointing knives, by which they will cut the edges of any width of shingle, the shingle itself operating the devices for holding the boxes firmly, and in the proper position, while the shingle is being cut as herein above set forth."

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66. For an *Improvement in Air-Heating Stoves;* J. M. Thatcher, Lansingburgh, New York, March 23.

Claim.—"What I claim as my invention is, the combination of the inverted domes, or frustums F, I, M, and plate P, with the short tubes *b b*, *f f*, *i i*, *l l*, connecting them substantially in the manner herein described, for the purpose of effecting the connexion between the lower ends of the fire or draft flues, and carrying the air through them to the spaces between the cylinders or tubes."

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67. For an *Improvement in Making Paraffine Oil;* James Young, Manchester, England, March 23; patented in England, October 7, 1850.

Claim.—"What I claim as my invention is, the obtaining of paraffine oil, or an oil containing paraffine, and paraffine from bituminous coals, by treating them in manner herein before described."

68. For an *Improvement in Sausage Stuffers;* Thomas W. Bailey, Lewistown, Pennsylvania, March 30.

Claim.—"Having thus fully described my improved sausage stuffer, what I claim therein is, the combination of the three cornered ovoid shaped cylinder, with the curved spring scraper, operating in the manner and for the purpose, substantially as herein fully set forth."

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69. For an *Improvement in Mills for Grinding Ores;* William Ball, Chicopee, Massachusetts, March 30.

Claim.—"What I claim as my invention is, the combination and arrangement of the two grinding, or pulverizing wheels, one or two endless screws, and the troughs which such wheels and screw, or screws, revolve in, all made and applied so as to operate together, in such manner as to raise the ore up and crush it between the two wheels, and not only return, or move the heavier or too weighty particles towards or back to the wheels, but allow the lighter ones or sufficiently reduced particles to flow out of the machine, as described."

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70. For an *Improvement in Excavating Machines;* Charles Bishop, Norwalk, Ohio, March 30.

"This invention consists in the employment of an inclined cutter wheel, so constructed that it serves also as a horse walk, by which means the power is applied directly to the wheel itself, without the intervention of other mechanism."

Claim.—"I do not claim inclining the cutter cylinder; neither do I claim placing the horses within or upon ditching machines, for the purpose of working them: but what I claim is, so constructing the inclined wheel or cutting cylinder E, that it is made also to serve the purpose of horse walk, by which means the power of the horse is applied directly to the cylinder itself, without the intervention of other mechanism, substantially as herein described."

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71. For an *Improvement in Trusses;* Frederick M. Butler, City of New York, March 30.

Claim.—"What I claim as my invention is, the application of trusses and supporters of the guard spring pad, as above described."

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72. For *Improvements in Machinery for Shaving the Heads of Screw Blanks, Rivets, etc.;* John Crum, Ramapo, New York, March 30.

Claim.—"What I claim as my invention is, the movable stop, which determines the position of the screw blanks between the jaws, and then returns to let said blanks fall through, substantially as specified, in combination with the vertical hollow spindle or mandrel, as specified.

"And finally, I claim the feeding tube, which conducts the screw blank, &c., to the hollow spindle, substantially as specified, in combination with the cam on the cutter head, or its equivalent, for moving the said tube out of the way of the cutter, as described."

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73 For an *Improvement in Razor Strops;* John Demerit, Montpelier, Vermont, March 30.

"The nature of my invention consists in attaching the strop, at the ends, to the case containing it, in such a way that it will be suspended, and revolve, without the edges touching the case."

Claim.—"What I claim as my invention is, the mode of attaching the strop to the case, so that it will not be soiled by the faces of it coming in contact with the case, and so that it will revolve, as herein described, using for that purpose, the aforesaid case, strop, bearing spring, and pivots, in combination."

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74. For an *Improvement in Dredging Machines;* James Hamilton, City of New York, March 30; patented in France, December 16, 1845.

Claim.—"I do not limit myself to the means described for raising and lowering the frame, nor to the shapes of the shovels or scoops, or the means of moving them, as other

mechanical means, shapes, or arrangements, may be used; neither do I limit myself in the number of the shovels, or scoops, or the proportions of the parts.

"1st, I claim the shovels or scoops, forming the bottoms of compartments in a proper frame, and moving at one end on a hinge, or similar contrivance, the other end being lowered, to cause the scoop, as the frame is moved along, to collect the sand, or mud, or other material operated on, and retain the same by suitable mechanical means, operating to lift the scoop and close the bottom, as described and shown."

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75. For an *Improvement in Rice Hullers;* Peter McKinlay, Charleston, South Carolina, March 30.

"The nature of my invention consists in having a circular conical chamber, into which the rice is put after having the outside shell taken off by a pair of stones, operated on in the usual way; the rice, after having the outer shell taken off, has still a thin film or skin on it, of a dark color.

"The object of my invention is, to take off this skin or film, by rotary friction, without breaking the grain, by which means the market value of the article is increased."

Claim.—"I claim as my invention, the combination of the concave fluted chambers, with the smooth curved radial beaters for hulling rice, as set forth."

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76. For an *Improvement in Shovel Ploughs;* Washington F. Pagett, Stone Bridge, Virginia, March 30.

Claim.—"What I claim as my invention is, the construction of the handles, and the principle or mode of shifting the same, as the same are herein fully described, with their operation; the invention of the common shovel plough is, of course, disclaimed."

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77. For *Electric Whaling Apparatus;* Dr. Albert Sonnenburg and Philipp Rechten, Bremen, Germany, Assignors to Christian A. Hainaken, United States, March 30.

"The nature of our invention consists in catching and securing sperm and right whales, as well as other animals of the sea, by the application of electric galvanic current, conveyed by a conductor to the instrument commonly called whale iron, or harpoon, and which is used to be thrown into the fish."

Claim.—"What we claim as our invention is, the application of electric galvanic current, conveyed by a conductor to an instrument which is to be thrown into sperm and right whales, as well as other animals of the sea, in order to secure them."

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78. For an *Improvement in Gang Ploughs;* Harvey Killam and George Valleau, Scottsville, New York, March 30.

Claim.—"Having thus described our improvements in the wheeled cultivating gang plough, we will state that we are aware that axles of wheels have been hung to the frame of the carriage, so as to vibrate, or be suffered to vibrate, and keep them at right angles to the motion of the ploughs, when moving in a direct line, and when the ploughs are turning the axles, being made to assume a line in the direction of the radius of the circle formed by the track of each wheel. We are also aware that gangs of ploughs have been placed diagonally, one behind the other, and the wheels of the carriage of the same also placed diagonally, one behind the other; therefore, we lay no claim to these parts. But what we do claim as our invention is, mounting the tongue or pole upon the timbers, and uniting the same by an intermediate jointed connecting rod, to the horizontal coupling rod, which unites the front and rearward ends of the pivoted arms of the axles, whereby the direction or guiding of the gang of ploughs is regulated by the action of the team itself, in moving in any direction the attendant may require.

"We also claim confining the tongue or pole between the horizontal plate and timber, by means of a fulcrum bolt, for the purpose of allowing the tongue or pole to vibrate, or move right or left, with the direction of the team; whereby the required direction is given to the propelling and supporting wheels, and whereby the tongue or pole may be shifted or adjusted in its position, to accommodate two or three horses, and yet maintain its central draft with the ploughs."

79. For an *Improvement in Bedstead Fastenings;* William Shaw, Clarion, Pennsylvania, March 30.

Claim.—"What I claim as my invention is, the combined actions, or the combination of the link and wedge as above described, for fastening bedsteads."

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80. For an *Improvement in Rat Traps;* James Sheward, Somerset, Ohio, March 30.

Claim.—"I do not claim any arrangement by which a living animal may be forced into a cage and retained; nor any arrangement by which an animal may be killed and its body retained: but what I claim as my invention is, the manner of constructing a machine for the killing of animals and throwing their bodies from the trap, and self-setting the same, substantially as described and shown."

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81. For an *Improvement in Apparatus for Boring Artesian Wells;* John Thomson, Philadelphia, Pennsylvania, March 30.

Claim.—"What I claim as new is, the spring or brace, as above described, or its equivalent, with the twisted flat bar, or other device, turning systematically the boring instrument, whilst using a rope instead of rods, while sinking a bore-hole in the earth, in search of water or minerals."

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82. For an *Improvement in Smoothing Irons;* Nicholas Taliaferro, Augusta, Ky., and William D. Cummings, Murphysville, Kentucky, March 30.

"The object of our invention is, to render practicable the permanent heating of smoothing irons, chiefly by the proper regulation and distribution of the draft to a charcoal or other fire within the iron, by an arrangement which prevents also the spilling of the ashes and refuse of combustion."

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of our improved smoothing iron, what we claim therein as new is, the application, substantially as described, to a self-heating smoothing iron, of a tube or chamber, at the bottom of the fire-box, provided with a registered mouth or inlet, some distance above the bottom, and at its lower portion with distributing apertures, communicating with the fire, whereby the draft is applied from beneath, and equally at every part, and placed under the control of the operator, without permitting the escape of ashes, or other refuse of combustion."

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83. For an *Improvement in Candle Wicks;* Cornelius A. Wortendyke, Godwinville, New Jersey, March 30.

Claim.—"I claim a candle wick, manufactured by the method herein specifically described."

Re-issues for March, 1852.

1. For an *Improvement in Machines for Planing, Tonguing, and Grooving;* Joseph Powell, Nelson Barlow, and Edward Holden, St. Louis, Missouri, Assignors to Rober G. Eunson, City of New York; patented February 27, 1847; re-issued March 9, 1852.

"The nature of this invention relates, 1st, To a method of springing and holding or confining the board or plank to the bed plate, while the thicknessing or reducing wheel or planes are operated upon it; 2d, To certain improved means of forming the tongue; and, 3d, To certain means of forming the groove."

Claim.—"What I claim as the invention of the aforesaid Joseph Powell, Nelson Barlow, and Edward Holden, and what I desire to secure by the re-issue of the letters patent granted originally to them, is, 1st, The combination of the pairs of feeding rollers, G G, and G′ G′, with the bed plate, C, and the rotating reducing wheel, D, substantially in the manner and for the purpose herein set forth, viz: the placing the axles of the pair of feeding rollers, G G, preceding the reducing cutter wheel, and the axles of the pair of feeding rollers, G′ G′, immediately following the same, respectively, out of a vertical line with

each other, thereby bringing the upper roller of each pair nearer to the shaft of the reducing wheel than the lower one, for the purpose of springing the board or plank to the bed plate, as herein more particularly described.

"2d, In making the rebates by which the tongue is formed, I claim the employment of a series of incising cutters, in combination with stationary planing tonguing cutters, the several cutters being so arranged as to act upon both sides of the angle of the rebate, simultaneously or alternately, and cut the shavings from both the said sides, so as to form at one operation a tongue, both of whose sides and shoulders have been subjected to the action of cutting edges, substantially as herein set forth.

"3d, In forming the groove, I claim the employment of a series of incising cutters, in combination with stationary planing grooving cutters, substantially as described, for forming the tongue, being arranged so as to cut upon both sides and the bottom of the groove, as set forth."

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2. For an *Improvement in Machinery for Dressing Staves;* Isaac Judson, New Haven Connecticut; patented May 1, 1847; re-issued March 9, 1852.

Claim.—"What I claim as my invention is, 1st, The arrangement of the wheel and ring of cutters, for the purpose and in the manner substantially as herein before described.

"2d, The holding of the stave firmly in position to be dressed, in the immediate vicinity of that portion which is being cut, while all the other portions are left at full liberty to assume whatever position its configuration may indicate for the purposes and in the manner substantially as herein before described.

"3d, The employment of the two independent spring rollers, or their equivalent, acting with equal force upon each of the edges of the stave, irrespective of their relative thickness, in combination with the guides and the cutters, as described."

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3. For a *Powder Proof Lock;* William Hall, Boston, Massachusetts; patented August 1, 1848; re-issued March 30, 1852.

Claim.—"What I claim as my invention is, the combination of the handle shank and cam, one or more pins, and their sustaining holes or apertures, in their application to the belt, and one or more tumblers, and as operated substantially as specified, meaning to claim said combination as composed of the afore described elements and their accessories, to combine with or in combination with the bolt and tumblers; a contrivance for throwing or moving the bolt back and forth; another, or a key, separate and distinct from such contrivance, and for the purpose of moving the tumblers into correct positions for the bolt to be moved, and which shall be perfectly stationary, after it has so moved the tumblers; and a movable plate, or its equivalent, applied to the contrivance, by which the bolt is actuated, and made to entirely cover the key, and prevent access to it, when the bolt is put in motion; not meaning by the above to claim the separate combination of either of the above mentioned three parts, with the bolt and tumblers, but intending to limit my claim to the combination of all of them therewith, so as to operate in conjunction with them, essentially as specified."

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48. For an *Improvement in the Gearing of a Seed Planter;* Marshall J. Hunt, Rising Sun, Maryland; patented June 3, 1851; re-issued March 30, 1852.

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with the slotted sliding seed bar, the stationary lugs on the plate, and the concave on the cap; the whole being arranged and constructed as herein described.

"I also claim the combination and arrangement of the double bolt, with its slotted arm, rock shaft, with its arms, and pitman, for the double purpose of giving motion to the feeding apparatus, and also regulating the quantity of seed to be sown, when said pitman is operated by a long crank, upon which it travels, as herein fully shown and represented."

Design for March, 1852.

1. For a *Design for a Cooking Stove;* Samuel M. Carpenter, Erie, Pennsylvania March 30.

Claim.—"Upon the general arrangement of said ornaments upon said stove, as an original design, your petitioner asks a patent under the provisions of law in such case made and provided."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on H. B. M. Screw Steam Frigate "Arrogant." By Chief Engineer, B. F. ISHERWOOD, *U. S. Navy.*

The *Arrogant* has long been considered the most successful application of an auxiliary screw to a war steamship. Having been furnished directly from her Chief Engineer with a number of her indicator cards, and accompanying data of speed, revolutions of screw, &c., I thought it might be of interest to steam engineers and ship constructors, to publish these results, giving additionally the full dimensions of *hull*, *engine*, *boilers*, and *screw*, obtained from the Chief Engineer of the vessel and other sources, in order that a correct opinion might be formed. As these results may be relied on, they will go far to correct some very exaggerated reports of the performance of this vessel, as well as to show the latest manner of using steam in the British Navy.

HULL.

Length between perpendiculars,	200	feet.	
Length of keel for tonnage,	172	"	9⅜ inches.
Breadth, extreme,	45	"	8½ "
Breadth, moulded,	44	"	4 "
Depth of lower hold,	15	"	1 "
Mean draft, half coal in, and all other weights full,	19	"	0 "
Burthen,	1872	tons.	
Displacement at 19 feet draft,	2470	"	
Immersed amidship section at 19 feet draft,	587	square feet.	

ENGINES.—Two of Penn's horizontal trunk, condensing engines, placed on board at Woolwich in 1848. The exhaust pipe, which is the highest part of the engines, is 4 feet 8 inches below the water line; the tops of the cylinders are 6 feet 11 in. below water line.

Diameter of cylinder, 60 inches, } " trunks, 24 " }	equivalent to a diameter of	55 inches.
Stroke of piston,	3	feet.
Space displacement of both pistons per stroke,	98·99	cubic feet.
Diameter of main steam pipe,	18	inches.
Leading into steam pipe of diameter of	14	"
Diameter of eduction pipes,	18	"
Diameter of overflow pipes,	18	"
Extreme length of engine and boiler rooms, bulkhead to bulkhead,	56	feet.

SLIDE VALVES.

Lead on top lid, or lid to cylinder cover,	3-16	inch.
Lead on bottom lid,	5-16	"
Carries steam on top stroke,	28	inches.
" bottom stroke,	26	"
Lead of exhaust on top lid of valve,	7½	"
" bottom lid of valve,	7½	"
Length of slide faces,	9	"
Length of ports,	5 7-16	"
Exhaust ports at bottom,	3⅜	"
" top,	3¼	"

Note.—When steam is admitted into the top end of the cylinder, the exhaust port is open 3 15-16 inches; and when admitted into the bottom end, the exhaust port is open 3¼ inches. The lead at the crank end of the cylinder is 5-16 inch, and at the cylinder cover end 3-16 inch.

SHAFTING.

Diameter of shaft at main bearing,	10½	inches.
" connecting shaft bearing,	9½	"
" screw propeller shaft at large end,	14	"
" " " small end,	9	"

Length of shafting from inside of stern post to forward part of coupling on crank shaft,	69 feet 1 inch.

Boilers.—Four horizontal tubular boilers, placed in such a manner that the top of the steam chest is 3 feet 4 inches below the water line.

Number of tubes in each boiler,		264.
Outside diameter of tubes,		2½ inches.
Length of tubes,		5 feet 6 inches.
Length of each boiler,		12 " 3 "
Breadth "		10 " 7 "
Height "		7 " 4 "
Number of furnaces in each boiler,		3.
Length of each furnace, that is, of grate bars in each furnace,		5 feet.
Breadth "	" "	3 "
Area of total grate surface,		180 square feet.
" heating " in tubes,	3800·544 sq. ft.	
" " " furnaces, &c.,	634·000 "	
Area of total heating surface in the 4 boilers,	———	4434.544 sq. feet.
Extreme height of chimney when up above grates,		44 feet.
Length of upper or sliding part of chimney,		15 feet 8 inches.
Diameter of lower or fixed part of chimney,		5 " 3¾ "
" upper or sliding part "		5 " 1½ "
Weight of water in boilers,		39 tons.
Consumption of English bituminous coal per 24 hours, working with full power at sea with steam alone, in good weather, boiler pressure 5 pounds per square inch, cut off at ⅜ths the stroke from commencement, making 44¾ double strokes of piston per minute, initial cylinder pressure 18 pounds per square inch,		32 tons.
Sea water evaporated under the above circumstances by one pound of coal, inclusive of loss by blowing off at 3-32, and by waste of steam in clearance and nozzles,		6·836 pounds.
Coal consumed per hour per square foot of grate surface,		16·600 "

Weight of coal carried in bunkers, 260 tons, or sufficient for 8 days steaming at full power.

Screw.—One true screw, placed at the stern in a sliding frame, so as to be raised out of water when the ship is under sail alone.

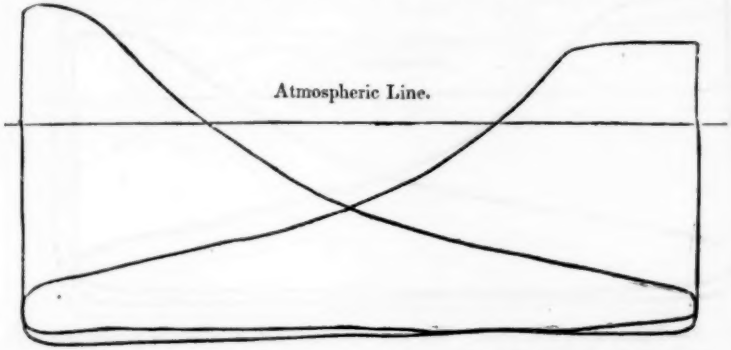
Diameter,	15 feet 6 inches.
Pitch,	15 " 0 "
Length on axis,	2 " 6 "
Number of blades,	2.
Helicoidal area of screw,	136 square feet.
Area of screw projected on a plane at right angles to axis,	61·85 "

Results.

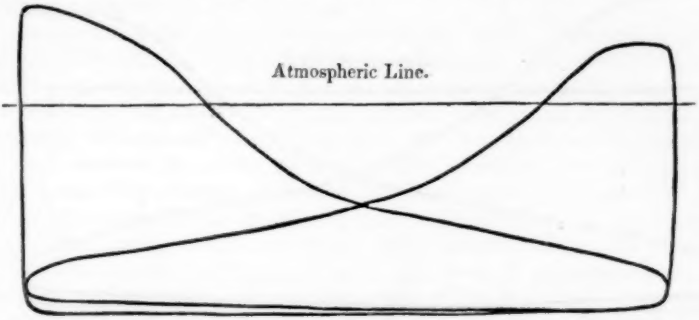
Speed of vessel at sea under steam alone, in good weather, working at the reduced power used in calms and smooth water, viz: cutting off at about ⅛th from commencement of stroke, and having a mean effective pressure per square inch of pistons throughout the stroke of 7¾ pounds, making 33¾ double strokes of piston per minute,	3·833	knots of 6082⅔ feet.
Horses power developed by engines under the above circumstances,	223·99	
Speed of vessel at sea under steam alone, in good weather, working with full power, viz: an initial pressure in cylinder of 18 pounds per square inch, cutting off at ⅜ths the stroke from the commencement, giving a mean effective pressure throughout the stroke of 13½ lbs. per square inch of pistons, making 44¾ double strokes of piston per minute,	5·08	knots of 6082⅔ feet.
Horses power developed by engines under the above circumstances,	520·96	
Slip of the screw under the above circumstances,	23·04	per cent.

INDICATOR DIAGRAMS FROM STEAM CYLINDERS. SCALE, 10 POUNDS TO THE INCH.

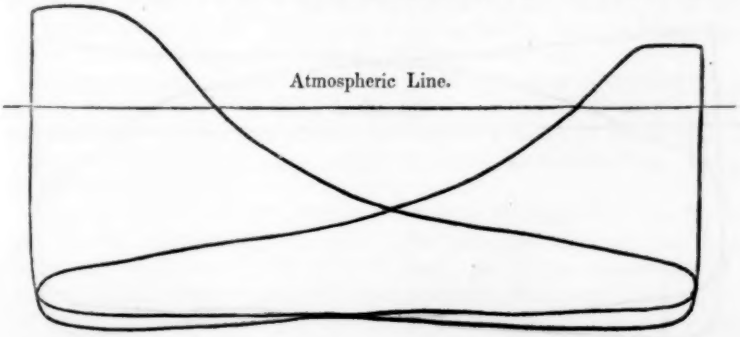
No. 1.—Taken August 4th, 1851. Sea smooth, and variable head airs; speed by paten log, 3·70 knots per hour; revolutions of the screw, 33 per minute; mean effective pressure per square inch of piston, 8·14 pounds. *Slip of the screw*, 24·22 *per cent.*



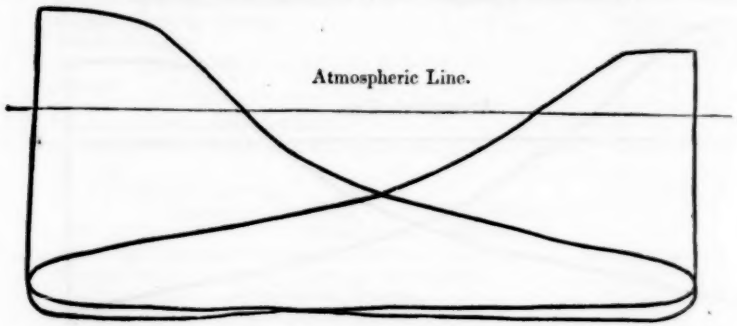
No. 2.—Taken August 5th, 1851. Moderate head swell, and airs ahead; speed by patent log, 4 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·48 pounds. *Slip of the screw*, 20·49 *per cent.*



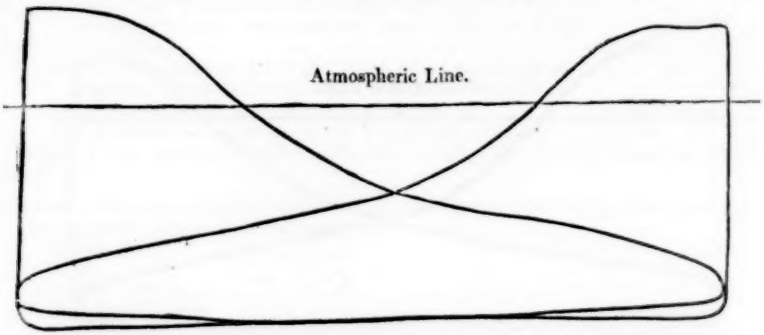
No. 3.—Taken August 4th, 1851. Sea smooth; fore and aft sails set; speed by patent log, 5·8 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·69 pounds. *Negative slip of the screw*, 15·29 *per cent.*



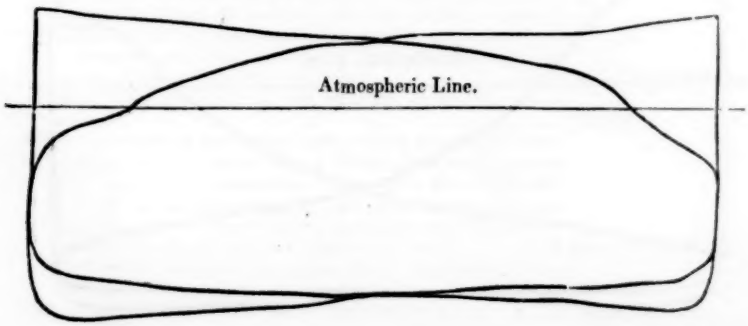
No. 4.—Taken August 5th, 1851. Sea smooth; calms and head airs; speed by patent log, 3·80 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·35 pounds. *Slip of the screw*, 24·46 *per cent.*



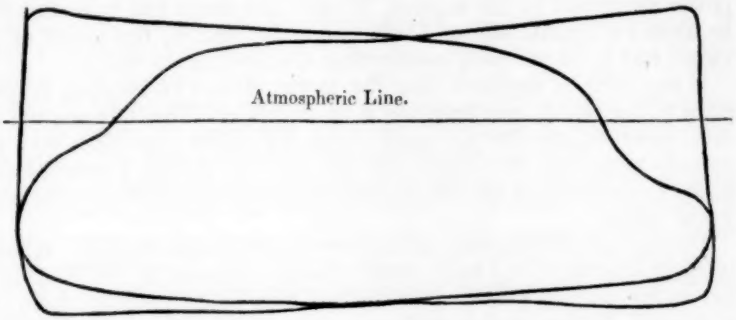
No. 5.—Taken May 4th, 1850. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 40 per minute; mean effective pressure per square inch of piston, 8·08 pounds. *Slip of the screw*, 29·04 *per cent.*



No. 6.—Taken August 5th, 1851. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 51 per minute; mean effective pressure per square inch of piston, 12·99 pounds. *Slip of the screw*, 44·34 *per cent.*



No. 7.—Taken August 2d, 1851, leaving Gibraltar for Lisbon. Sea smooth, strong free wind, and all sail set; speed by patent log, 10·60 knots per hour; revolutions of the screw, 64 per minute; mean effective pressure per square inch of piston, 13·88 pounds. *Negative slip of the screw*, 11·94 *per cent.*



All the above diagrams, excepting No. 5, were taken on a passage from Gibraltar to Lisbon, with a mean draft of about 19 feet, and show the performance of the vessel under the most favorable circumstances, having a smooth sea and short run.

Under these favorable circumstances, the mean performance at sea, under steam alone, was for full power; that is, a mean effective pressure of 13½ pounds per square inch of piston, and 44⅔ double strokes of piston per minute, 5·08 knots; and for the reduced power used in calms and fine weather, viz: a mean effective pressure of 7⅔ pounds per square inch of piston, obtained by cutting off at about ⅛th the stroke from the commencement, and 33⅓ double strokes of piston per minute, a speed of 3·833 knots per hour. These are slow speeds, and would not by any means be considered satisfactory in our Navy. Every war steamship with us, having a less average sea speed than 9 knots per hour, is pronounced a failure, without regard to the comparative power of the machinery, consumption of fuel, and size of vessel. It is thus that nearly all our Navy steamships are failures; but fairly compared relatively, power with power, fuel with fuel, and size of vessel with size of vessel, I believe our Navy war steamships will be found to give higher results, both in the generation of steam, its mode of use in the engine, and application to the propelling instrument, than can be found elsewhere, at home or abroad.

These diagrams also show in a very striking manner, the effect of using sail in conjunction with the screw, and the existence of what is termed *negative* slip. A few remarks on this subject may be of use in this connexion; sufficient data being luckily furnished by a trial of the *Arrogant* in the Thames river.

January 8th, 1849, the *Arrogant*, drawing 16 feet 10 inches forward, and 18 feet 9 inches aft, was tried at the measured mile in the Thames river, and made at the rate of 7·25 knots per hour; revolutions of the screw, 63 per minute; mean effective pressure per square inch of pistons by indicator, 13·31 pounds; horses power developed by the engines, 672·7. *Slip of the screw*, 22·23 *per cent.*

August 2d, 1851, the *Arrogant*, leaving Gibraltar for Lisbon, made, in smooth water, strong free wind, and all sail set, 10·60 knots per hour by patent log; revolutions of the screw, 64 per minute; mean effective pressure per square inch of pistons by indicator, 13·88 pounds; horses power developed by the engines, 767·45. The screw had now what may be termed a *negative* slip of 11·94 per cent.; that is, the speed of the vessel was 11·94 per cent. *greater* than the speed of the screw.

It may now be supposed that the screw, instead of assisting the progress of the vessel, was retarding it by dragging. That this was not the case, however, and that the screw under the above conditions was still actually propelling the vessel, will become evident from a consideration of the performance of the vessel in the Thames river, as given in the paragraph above.

During that performance, with 63 revolutions of the screw per minute, (slightly less than 64,) and a mean effective pressure of 13·31 pounds per square inch of pistons, (slightly less than 13·38 pounds,) there was developed by the engines sufficient power, (672·7 horses,) after overcoming the screw resistances of the front edges of the blades, and surface friction on the water, and engine resistances of friction and load on air pump, and also friction of load on the engines, to drive the vessel 7·25 knots per hour.

During the performance on the 2d of August, when the screw made 64 revolutions per minute, the above named screw and engine resistances may be considered practically the same as with 63 revolutions. The power now developed by the engines was 767·45 horses. But if the speed of the screw were now really less than the speed of the vessel, and retarding it by dragging, the screw would be assisted in its revolutions by the reaction of the water caused by that greater speed of the vessel; consequently there would not be required to be exerted by the engines, in order to overcome the screw and engine resistances, as much power as was required when making the 63 revolutions in the Thames river; yet the total power now developed by the engines was greater than before, viz: 767·45, instead of 672·7, while a less power than before was required to overcome the screw and engine resistances. What then has become of the large remainder of this power? It must have been expended on some resistance, and the only resistances opposed to the power of a steam engine, in propelling a vessel by a screw, are the screw and engine resistances, the friction of the load, and the resistance of the vessel itself. We have seen, however, that but a small portion of the power developed by the engines was absorbed in overcoming the screw, engine, and friction resistances; the remainder therefore must have been expended in overcoming the resistance of the vessel; that is, in propelling the vessel; notwithstanding that the vessel was *apparently* going faster than the screw, and could not therefore be propelled by it. A little attention to what takes place in the passage of a body through water, will reconcile the contradiction.

It is familiar to all, that when a body passes through water, it leaves a vacuity behind, which is filled by the inrushing water. It is impossible in any case, that this vacuity can be made and filled simultaneously; *time*

is required for the operation, and the effect of time is to generate a current, or give velocity to the inrushing water: for as the water falls into the vacuity by its gravity, the speed of its current or its velocity will be proportional to the time required for the water thus to fall in. No matter how fine the after lines of a vessel may be, or how slow its speed, it must have, when in motion, *some* following current, and this current will be in some proportion to the fineness of the after lines and the speed of the vessel. The finer the lines and the less the speed, the less will be the velocity of the following current, because less time will elapse before the following water will have fallen in; or in other words, the following water will have a less distance to flow before it fills the vacuity.

An illustration of the same thing may be had by observing the eddy at the back end of a bridge pier placed in a current of water. A chip thrown into the current at the front end of the pier, close beside it, will not be carried straight on, but will close in behind the pier, and remain at rest.

With a hull of the *Arrogant's* proportions, moving through the water at the high velocity of 10·60 knots per hour, it is very probable the following current had a considerable velocity, and as the screw acted in and against this following current, it might have had a very *positive* slip, comparing the speed of the screw with the vessel's speed diminished by the speed of this current; while it had a *negative* slip, compared with the vessel's absolute speed through the water, supposing no following current to exist, and that the vessel and screw moved through the water in the same condition.

If the water were passing the screw at the vessel's speed, it would pass at the rate of 10·60 knots per hour; but if there were a following current of say 1·60 knots per hour, the water would only pass the screw at the rate of 9 knots per hour. The speed of the screw should therefore be compared with the latter rate, which, if it could be ascertained, would give the *true* slip of the screw, a slip that would always be found a *positive* one.

It must here be distinctly remembered, that a negative slip can only happen when the vessel has a high speed, and owes a considerable portion of it to a power additional to that applied to the screw, that of the sails, for instance; though it has frequently been reported to exist, when the vessel was being propelled by the screw alone. In these cases, it was manifestly the result either of inaccurate observations of distance gone, and revolutions made, or of a mistake in the pitch of the screw, reckoning it less than it actually was.

Supposing the motion of the vessel through the water to leave no vacuity behind it, the resistance of the vessel would occasion a certain positive slip of the screw. Now, suppose this vacuity to exist, the bow resistance of the vessel would be increased by it, and by consequence the slip of the screw would be increased. Now, suppose also, that by reason of this vacuity, a following current be generated, which striking the screw diminishes again the increased slip; it is evident that this following current cannot impart *more* power than was absorbed in generating it; that is to say, that its additional resistance to the screw can only equal the additional resistance at the bow, thrown upon the screw by the genera-

tion of this current. Under the most favorable circumstances, then, the slip would remain the same, either with or without the following current; but in practice it cannot at all retain this equality, for the whole of the power bestowed in generating the following current, and resident in it, cannot be re-applied to the screw; in fact, but a small quantity can be so regained. To say, that in a vessel propelled by a screw alone, the vessel's speed could surpass that of the screw, would be to say, that in the case of a man wheeling a wheelbarrow, the speed of the wheelbarrow surpassed that of the man.

For the Journal of the Franklin Institute.

An Account of the Explosion of the Steamboat "Brilliant." By A. C. Jones, Esq., *Engineer.*

To the Committee on Publications.

Gentlemen:—Circumstances prevented my forwarding to you the account of the *last* explosion on the steamboat *Brilliant* at the time of its occurrence; it presenting some new features in recklessness, may even a this late day be acceptable to the readers of the Journal. As the same boat collapsed a flue last July, I will include both accidents (!) in this paper.

New boats are heralded with many safety contrivances; but not one states, (nor could many with truth,) that they have competent engineers. The advertisement of the new *Brilliant* ran thus:—"The Brilliant has more securities for the protection of passengers than any boat afloat, having the steam indicator, the water indicator, and in the event of fire, can flood the hold in an instant with steam, and is now offered to the public as the fastest boat on the river," &c.

The *Brilliant* was principally owned by planters on the "coast,"* and was intended to be one of the "crack packets;" from causes which it is not necessary to enumerate, she was not one of the "fast ones," unless the boilers were hard pushed; and to have this done, the captain being a "hot man," employed "*hot engineers.*"†

On the third trip, at 6 A. M., about five miles below the town of Plaquemine, the inboard flue of the larboard outside boiler collapsed, scalding several and killing four or five men. No injury was done to the boat.

This is an extract from a newspaper of the day:—"Captain Hart intends remaining here until a full judicial examination is had of the boilers, and the cause of the collapse. He has demanded the examination

*Both banks of the lower Mississippi river are so termed.

†This is the name applied to those miscalled engineers, whose rashness, coupled with ignorance, leads them to increase the pressure by overloading the safety valve, and by the hardest kind of firing, force the boat, at the risk of all on board, to go a little faster than their predecessors had done before. Strange to say, this worthless tribe bid fair to drive prudent engineers off the river.

before the U. S. Commissioner." Collapsing a flue being too trifling a matter for the attention of the Commissioner, no examination was had, and yet a proper inquiry might have led to the prevention of the last catastrophe, as the cause was similar in both cases, EXCESSIVE PRESSURE. On a personal examination, I found the flue collapsed its whole length, and partly torn from the boiler heads, (wrought iron.) The torn edges of the sheets presented a bright clean surface, and had every appearance of being soft and tough; the after sheet is slightly laminated, but on the whole is excellent iron.* The water line in the boiler showed that the water was flush at the time of the collapse; and this is borne out by the positions of the three gauge cocks, the lowest one being *four inches above the tops of the flues.* As they understood the true policy of carrying a good head of water, the cause is easily arrived at. The objectionable feature in most of the boilers on the river, is having the flues so large as to leave little water space between the flue and the shell. In this case, at the after end it is under $1\frac{3}{4}$ inches, and it may have been still less at intermediate parts between the heads. With hard firing, the heat acting on both sides of this film of water, causes it to be repelled, and the flue and shell along that line becoming overheated, and the flue being the weakest, prepares the way for a collapse, and sometimes an explosion. That this want of water space is a primary cause, is proved by the inspection of collapsed flues, where the water in the boiler was ample at the time of the flues giving way; eight out of ten are flattened in a line drawn from this contracted space through the axis of the flues, thus: the tearing or separation from the heads generally following the collapse.

The Explosion.—Some time after the collapse, new boilers of heavier iron were put into the boat, and the fall business commenced. Not yet being able to beat every thing on the river, (and the former collapse being forgotten,) caused a change of "*hot engineers*" from trip to trip. The last trip but one, the Captain employed at *extra wages*, "*the hottest man on the river*," as second engineer. This man was in charge at the time of the explosion.

On September 28th, 1851, about $8\frac{1}{2}$ A. M., while backing out from Dr. Stone's Plantation,† the second starboard boiler exploded as soon as the engines were put in motion. The killed and missing exceeded sixty persons.

A short period prior to the explosion, it was said by persons on board at the time, that the engineer on duty, in reply to the Captain's urging him to increase the speed, stated that the boilers would not bear more steam. All accounts agree that they had been firing as hard as they could,

*So far as the toughness of the iron is concerned, this will hold good; but it is of too soft a nature for flues. I am not aware of any experiments having been made on flues, to test their resistance to the crushing force tending to collapse; but it seems to be lost sight of, that hard stiff iron would be preferable to the soft Western iron plates generally used for flues.

†This was likewise on a Sunday morning, and almost on the same spot where the former collapse occurred.

and using rosin freely at the time. *No steam was allowed to escape during the stop at the landing*, which was about four minutes.

There were five 42-inch boilers, with wrought heads, and 16-inch double flues, all being of heavy iron; the water space in these (like those they replaced,) was about two inches.

It appears that this boiler was torn asunder; the shell and part of the flues passing forward like a rocket over the starboard bow into the river; the remaining boilers are only displaced, the after ends having settled down; the doctor, steam drum, and pipes being slightly injured; the safety valve broken, and lever bent. Over and abaft the boilers, is a large breach in the cabin floor, through which passed a great quantity of water and steam, wetting every thing in the saloon to the after end of the ladies' cabin, much of the furniture being broken and destroyed. Twenty feet from the edge of the hole, lay two pieces of cast iron, being part of the flue return plate; fifteen feet further aft is the manhead, one bolt being broken; and near by is the lead gasket, which had formed the joint, and is crumpled up, but not melted. There were a few more fragments of iron on this deck.

Returning to the main deck, about five feet abaft the ends of the boilers, on the larboard side, partly across the boat, lay a piece of collapsed flue, doubled up in its length, so that its cross section has the form of a horse-shoe, **U**. On the platform, alongside of the starboard engine, is a piece of flue, (see sketch,) about two feet long, partly collapsed; the end, A, having by some means become partly shaved by contact with other iron. I send you a small spinicle broken off the flue; it is of a beautiful pink and orange color, caused by friction; and with it two pieces of lead; the small piece was taken from the chock joint of the remaining starboard boiler; the largest piece of lead is part of the chock joint of the other side of the exploded boiler. The lead in these chock joints, and the pieces of flues, prove that it was not for want of water that the boiler gave way; but simply by the excessive pressure at the time, from the steam being kept in, *although making fast*, and probably being increased at the instant by filling the cylinder quickly with steam, thereby creating a shock, which caused this overstrained boiler to yield.

Both engineers being dead, not the slightest attempt has been made to bring the surviving master spirit to justice, for this wilful and wanton destruction of life.

P. S. I shall forward you in a few days, the last explosion of the tow-boat *Mary Kingsland.*

New Orleans, February 23d, 1852.

For the Journal of the Franklin Institute.

Queries, by DR. HARE, *to* PROF. ESPY, *or to Meteorologists in general, induced mainly by certain generalizations in Espy's Report to the Naval Department.*

Having been called on officially to give his opinions on Prof. Espy's labors, Dr. Hare has preferred to publish them in full, rather than resort to a brief epistolary juridical communication.

The subjoined generalizations are quoted from the quarto pamphlet, entitled Espy's Report on Meteorology, page 5.

1. "The rain and snow storms, and even the moderate rains and snows, travel from the west towards the east in the United States, during the months of November, December, January, February, and March, which are the only months to which these generalizations apply."

2. "The storms are accompanied with a depression of the barometer near the central line of the storm."

3. "This central line of minimum pressure is generally of great length from north and south, and moves side foremost towards the east."

5. "The velocity of this line is such that it travels from the Mississippi to the Connecticut river in about twenty-four hours, and from the Connecticut to St. Johns, Newfoundland, in nearly the same time, or about thirty-six miles an hour."

7. "In great storms, the wind, for several hundred miles on both sides of the line of minimum pressure, blows towards that line directly, or obliquely."

10. "Many storms are of great and unknown length, from north to south, reaching beyond our observers on the Gulf of Mexico and on the northern lakes, while their east and west diameter is comparatively small. The storms, therefore, move side foremost."

11. "Most storms commence in the 'far west,' beyond our most Western observers; but some commence in the United States."

13. "There is generally a lull of wind at the line of minimum pressure, and sometimes a calm."

Queries submitted for the consideration of Prof. Espy, before making his next Report.

1. Has not experience established that vessels in approaching the Atlantic coast of the United States, are liable to be subjected, in the first instance, to a violent south-easter, then to a calm, or lull, followed by a north-wester, no less violent than the gale first encountered?

2. Whether the gale of 1836, of which the phenomena were recorded by Prof. Loomis, and published in the Transactions of the American Philosophical Society soon after, does not exemplify the origin and progress of such gales, by showing that the wind blew from between north and west, towards an oblong area of minimum barometric pressure, on one

side; while it blew towards that area on the other side, from the opposite quadrant of the horizon, between south and east.

3. Whether the observations thus recorded, do not show that the area of minimum pressure moved gradually from the north-west towards south-east, subjecting every station successively exposed to it, first to a south-easter, then to a lull, and finally to a north-wester?

4. Whether the course of this storm was not from north-west to south-east; and whether it did not, in this respect, agree with the well known gales, or hurricanes, above adverted to as universally called south-easters?

5. These premises admitted, Mr. Espy is requested to explain wherefore in one of his generalizations, he alleges that storms travel from *West* towards the *East* during the five winter months, instead of alleging that they travel from north-west to south-east, consistently with the observations of Loomis above mentioned?

6. Whether, if the language of the generalization were accurate, all gales experienced on the United States coast, would not blow from due east first, and from due west afterwards?

7. Whether there is not another distinct kind of storm, long known and universally recognised as the "north-easter" or "north-eastern gale," which has been distinguished from the south-easter, so called, by its direction, its longer endurance, lesser violence, and by its not being usually followed, after a brief lull, by a north-wester; nor any violent wind in a direction directly opposite to that in which it blew at the beginning of the storm?

8. Whether, moreover, co-existent with this north-eastern gale, there are not always upper clouds, which are to be seen occasionally through openings in the rainy strata, which upper clouds move slowly from the south-west in a direction nearly opposite to that which the scud pursues?

9. Whether, agreeably to the observations of Franklin, and general experience confirming them, our storms producing north-eastern gales do not travel from south-west to north-east, so that they are perceived earlier as the place of exposure is more to leeward?

10. Whether their traveling thus, does not warrant the opinion that they commence in the Gulf of Mexico, and are propagated gradually to the north-east along the Atlantic States, and the neighboring portion of the Atlantic ocean?

11. Whether the observations of Redfield do not establish, so far as they are reliable, that certain storms travel from the Gulf along the coast of the United States, and of course from south-west to north-east; and how these results are to be reconciled with the generalization in the report, or with the evidence adduced by Loomis?

12. Whether any absurdity which Redfield's inferences involve respecting the interior phenomena of his suppositious whirlwinds, justify distrust of the correctness of the route which they are represented to have pursued?

13. Whether we are to admit a generalization, which agrees neither with Loomis, Franklin, nor Redfield?

14. How can the observations of Franklin, confirmed by a very gene-

ral impression that they were sagacious and well founded, be reconciled with those made by Loomis, also highly esteemed, unless there be two kinds of storms, one of which travels from the *north-west* to *south-east*, the other from *south-west* to *north-east*?

15. Whether it can be correct to confound both of these kinds of storms under the one generalization of "*Storms moving from west to east?*"

16. Whether there is any difference in the direction of storms during the warmer months, justifying the restrictions to the colder season, of the generalization that storms move from east to west?

17. Do not tornadoes always move, whether in summer or winter, from north-west to south-east?

18. Do not thunder gusts almost invariably move from west to east, usually from N. W. to S. E.?

19. Whether there is any coincidence as to time between the prevalence of the terrific Norther of the Mexican Gulf Coast, and that of our north-east gales?

20. Whether they are not both consequent to the displacement of the warmer air lying on the Gulf, by the colder air of the territory of the United States, north or north-east of the Gulf, to whatever cause that displacement may be due?

21. Whether simultaneously with the existence of the norther on the western coast of the Gulf, there *is*, or *is not*, a north-easter blowing from the United States territory eastward of the Allegheny ridge, into the aerial estuary over the gulf?

22. There being three different climates within the territory of Mexico, according to the altitude of the localities throughout which they prevail, the lower being designated as the hot region, the middle as the rainy region, and the upper or table land of the City of Mexico, as the mild and dry region; whether it is not evident that the clouds of the Gulf do not ever cross the table land; but by their access to the intermediate region, cause its characteristic humidity?

23. Whether in point of fact, the climate of the table land of Mexico and that of the Gulf, are not independent of each other, so that however an ascent of the air of a portion of the Gulf, may render an horizontal afflux to supply its place necessary, the effect will be to draw the whole supply from the lower and comparatively cooler territory of the United States, lying to the north and east of the Gulf?

24. Whether, as the area of the Gulf reaches to nearly two-thirds of the size of the Valley of the Mississippi, and the territory of the Atlantic States, it should not have a great influence on the winds of the United States, and whether it does not justify a doubt of the correctness of any sweeping generalization which does not admit that great estuary to have any influence?

25. Whether the prevalence of gales supposed generally to occur about the time of the Autumnal Equinox, may not be explained by this fact, that the decline of the solar heat in September, cools the land more than the seas by which it is bounded; whence it follows that at this season of terrestrial refrigeration, there will be greater propensity for the air over the land, to displace that of the adjoining seas; and whether this process is not likely to be peculiarly influential in the case of the Gulf of Mexico,

and the territory of the United States, thus creating an unusual tendency to the production of north-east gales about the time of the equinox?

26. Whether the north-eastern gale does not cease to be a rainy wind at a certain distance from the United States coast, and if so, at what distance does it become a dry wind, a harbinger of a cloudless sky?

27. Whether this diversity in the character of the north-easter, may not be fairly ascribed to the facts above cited in relation to the Gulf of Mexico, since when the gale in question blows into the basin of that estuary, the air displaced by it being incapable of surmounting the barrier made by the table land and mountains, so as to get off to leeward, it has to flow back over the inblowing gale, furnishing thus the moisture which forms its well known attribute?

28. Whether the fact that, beyond the range of our Atlantic coast, there is no such basin and barrier, is not the reason of there being no moisture associated with winds having a north-eastern direction, since in that case there is no barrier to cause the moist air displaced to flow in an opposite course above that of the displacing current below?

29. Whether the general tendency of the wind, in the upper region, to move from south-west to north-east, over the United States territory, does not fortify the idea that the warm and moist air, displaced from the Gulf, must pursue an opposite route to that of the lower wind, by which it may be supplanted?*

Queries respecting the conflicting explanations of the causes of Tornados and and Water Spouts.

The preceding queries are intended to draw attention to those points of view in which the generalizations of Prof. Espy are apparently irreconcileable with well known facts, extensive experience, or the observations of other meteorologists; but as the learned Professor mingles references to his theory incessantly with his observations, I request that he answer some queries bearing thereupon.

I therefore propose the following inquiries:

Whether there are not two well known modes of electrical discharge, by which bodies oppositely electrified are made to neutralize each other, in one of which, electricity passes in a spark, in the other, is conveyed from one surface to the other, by the motion of some intervening body; whence the alternate motion of clappers between bells, of pith balls, or puppets between disks, and of blasts of air from electrified points.

The existence of these modes of discharge being admitted, and also that one of them has been called the spark, or diruptive discharge, the other, the carrying or convective discharge. I ask whether any charge whatever, may not be neutralized either by the convective or diruptive process, so that the one is commutable for the other by a slight diversity of distance.

Whether in every case of the existence of an electric charge, attraction does not take place between the surfaces, or bodies employed to hold it?

* Prof. Espy may probably consider his generalizations as justified by the plotted record of his observations, but the examination of them has not created that impression. He has lectured and reported upon his own theory and observations, without bringing those of his predecessors or contemporaries sufficiently into view.

Whether it does not follow, that wherever there can be a charge competent to produce the diruptive spark discharge, there must be a competency to produce the convective discharge?

These premises conceded, and it being admitted that lightning is a diruptive discharge on a gigantic scale, does it not follow that there must be a gigantic convective discharge in nature upon a scale of commensurate magnitude?

Let Mr. Espy say where that convective discharge is to be found, if it be not in the tornado or water spout?

Let him say in what respect the features of the tornado are discordant with those of a convective electrical discharge?

Let him say why the phenomena observed by Allen, are not a magnificent illustration of the alternation of the convective and diruptive discharge?*

Is not Prof. Espy aware that the immediate mechanical causes of the devastation produced by tornadoes and water spouts, were never well ascertained prior to the observations made respecting the tornado of New Brunswick in June, 1835, especially by means of the survey made by Professor A. D. Bache and himself.

Moreover, that agreeably to the observations and survey alluded to, it was shown that tornadoes consist of an upward blast of air about the axis, and horizontal confluent blasts from all quarters to supply the upward blast, the axis having a progressive velocity?

While at that time, by Prof. Espy, the ascentional force was attributed to a buoyancy arising from the heat, evolved by aqueous vapor in condensing within the upper part of a rising column of air, was it not by me ascribed to a discharge of electricity between the earth and sky, and superseding the discharge in the form of lightning? Did not Mr. Espy know that this explanation was the subject of a memoir published in the transactions of the American Philosophical Society, in vol. v. 1836; subsequently published in Silliman's Journal, vol. xxxii, 1837?

As the volumes of the Society above mentioned are invariably sent to the Academy of Sciences, at Paris, soon after being issued, was not Prof. Espy aware that the volume containing my memoir must have been in the library of that academy, when in 1840 his theory was submitted to the committee appointed to report upon it.

In his book, entitled "Philosophy of Storms," an account is quoted from Peltier, of a tornado which occurred at Chatenay, near Paris, by which a chateau and its park were devastated. Was not Professor Espy informed that this account of Peltier was comprised in a report made under the following circumstances:

*The observations of Mr. Allen were stated in the following words:—"Being within a few yards of this spot, I had an opportunity of accurately noting the effects produced on the surface of the water. The circle formed by the tornado on the foaming water was about 300 feet in diameter. Within this circle the water appeared to be in commotion, like that in a huge boiling cauldron. The waves heaved and swelled, whenever the point of this cone passed over them, apparently as if some magical spell were acting upon them by the effect of enchantment. *Twice I noticed a gleam of lightning, or of electric fluid to dart through the column of vapor. After the flash, the foam of the water seemed immediately to diminish for a moment, as if the discharge of the electric fluid had served to calm the excitement on its agitated surface.*"

The chateau being insured against damage done by thunder storms, indemnity was claimed; but the insurers objected, that the tornado was not a thunder storm. Hence the question was referred to Arago, President of the Academy. This distinguished savan, being unable to attend personally, deputed Peltier; who, after an investigation of the phenomena, and examination of witnesses, adopted my explanation, so far as this, that the tornado, by intervening between the earth and sky, supersedes the more usual mode of discharge by lightning.

When the Professor was submitting his views to Mr. Babinet, was he ignorant of the following facts, which I afterwards learned from the parties themselves: that Arago was so occupied with business to which he was subjected by the Government and the Academy, that he could not give any attention to Prof. Espy's application; that Pouillet not agreeing with Babinet, and Arago not attending, left to Babinet exclusively to report upon the Espyan theory; and that Babinet, more distinguished as a profound mathematician, than as a well informed meteorologist, made his report in ignorance of the existence of my memoir, of Peltier's report, or the consequent judgment against the insurers?

Is it not evident, therefore, that the report made by Babinet, and signed by Arago and Pouillet, was obtained upon exparte representations hrough neglect and ignorance, and that either on the one hand, gross inustice had been done to the insurers in being made to pay for it as an electrical storm, or on the other, the report did injustice to the cause of scientific truth, in ascribing it to heat?

Is it not evident that when a balloon rises it is pressed up, by the wedging in under it of the heavier surrounding air, and that this, while it presses the balloon upwards, presses downwards on the column of air immediately under it?

If this be a true representation of the process by which a balloon is elevated, how could the ascent of a balloon, however great, at the level of the clouds, disturb the column of air supporting the balloon, so low down as the base resting on the terrestrial surface.

Does not this reasoning apply equally to a mass of air warmer than that surrounding it, in consequence of the latent heat yielded by condensation of the contained vapor?

Is not this the reason why the inflammation of a stratum of carded cotton above the mouth of an inverted open necked bell glass, produced not the slightest movement in fibres of the same material, situated on a wire gauze within the bell immediately over the bore of the neck?

Are not all the Espyan requisites for the production of a tornado to be found in the upward current of air over equatorial regions, by which the trade winds are induced? If so, wherefore does not a tornado prevail there, as enduring as that upward current?

Queries to Meteorologists generally.

The following queries are not made with any reference to Espy's theory or generalizations; but with a view to complete the series which has at this time been suggested to me as worthy of the attention of meteorologists.

Does it not follow that whenever any portion of the atmosphere is charged positively, or negatively, the aerial particles must undergo a corresponding rarefaction from the reciprocal repulsion consequent to a similar state of electrical excitement? May not this be one cause of a buoyancy and consequent ascentional power, producing a penetration of the region of frost, by the lower strata of the atmosphere?

Whenever electrical repulsion tends to counteract gravitation, is it not reasonable that barometrical pressure should be diminished, and may not oppositely charged aerial masses by rushing together, sustain a diminution of volume, and cause a precipitation of vapor as rain, by super-saturating the space within which they commingle?

If, as above suggested, a diversity of electrical excitement be followed by corresponding variations of the density of the air and of the space occupied by it; whenever by such means a dilatation of bulk occurs in a mass of the atmosphere, will it not take up any moisture to which there may be access sufficient to saturate the additional space occupied; and whenever the opposite change of diminution of volume ensues, will it not deposit a proportionable quantity of moisture?

Is not the action of the air in this respect in taking up and giving out moisture, analogous to that of a sponge, which absorbs or gives out any surrounding liquid, accordingly as it may be allowed to dilate by its own elasticity, or made to contract by mechanical compression?

May not each globule of water in a cloud be inflated with air like a bubble, while this bubble may be expanded by electrical repulsion, so as to be more buoyant, than if it were electrically neutral, and may not this be one cause of the buoyancy of clouds?

May not a buoyancy thus arising, be one source of ascentional power inducing those upward currents which cause rain?

It is well known that clouds intercept the radiant heat given off by the terrestrial surface to such an extent, that white frost, which is always the consequence of radiation, only takes place when the sky is clear. Does it not follow that the clouds must acquire heat by terrestrial radiation, so that the air with which they are associated must consequently be made warmer and more buoyant than it would otherwise be?

Have we not reason, then, to infer, that the heat arising from terrestrial radiation is one of the causes of the buoyancy of clouds?

Nevertheless, generally, is not the persistence of clouds only apparent? Are they not formed as the vapor, in any rising column of air, reaches the level where there is sufficient refrigeration to condense it; but is not the cloud thus formed, dissolved usually by the air above, of which the dew point is so low as to enable it to take up the precipitated vapor?

Are not the phenomena analogous to those of the fog or cloud, which may appear to surmount *persistently*, the escape pipe of a steamboat boiler, although this is manifestly the effect of a successive condensation of succeeding portions of the aqueous vapor?

Dimensions and Computations of the Pittsburg and Cincinnati Packets, and some of the other large Steam Vessels which navigate the Ohio River, above or below the Falls, extracted from the Report of Proceedings in the matter of the Wheeling Bridge Case; being a portion of the Report of Wm. J. McAlpine, Esq., C. E., *to* Hon. R. H. Walworth, *Commissioner of the Supreme Court of the United States.*

PARTS MEASURED, in feet and in decimals of a foot.	Pittsburg and Cincinnati Packets.							Louisville and Cincinnati Packets.		Louisville and New Orleans Steamboats.				Steubenville and Wheel'g Packet.	Louisville and Frankf't Packet.
	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Lengths—															
Stem to stern	215·	227·	250·	264·	244·	242·	226·	255·	..	265·	266·	265·	295·	172·	153·
Stem to promenade deck	28·	28·	28·	28·	29·	28·	28·	..	..	25·	26·	28·	35·	27·	21·
Stem to boilers	59·	71·	73·	81·	71·	73·	73·	80·	..	75·	82·	83·	88·	55·	40·
Stem to wheelshaft	145·	157·	162·	172·	160·	157·	152·	165·	..	173·	169·	177·	186·	129·	108·
Of pilot house	9·	8·	8·	10·	8·	8·	8·	11·	..	12·	10·	14·	16·	..	10·
Breadths—															
Of beam	32·	32·	30·	30·	31·	31·	28·	34·	..	34·	34·	33·	35·	27·	27·
Outside of guards	54·	58·	57·	56·	58·	55·	54·	66·	..	66·	69·	69·	72·	..	37·
Of pilot house	15·	15·	12·	12·	12·	12·	14·	13·	..	14·	13·	13·	16·	..	10·
Depth of hold	6·9	7·5	7·2	7·8	7·2	7·4	7·	7·	..	7·5	8·	8·	9·	5·6	5·7
Draft when light	3·2	3·5	3·3	3·5	2·9	3·3	3·5	..	3·5	4·7	3·8	..	4·4	1·8	2·7
Heights above the surface of the water when light—															
Main deck	4·4	4·0	4·3	4·5	4·2	4·3	3·5	3·3	4·2	3·5	4·	4·3	6·0	..	3·7
Promenade deck	16·8	16·	16·	16·	15·	16·	14·5	15·	17·8	15·8	16·3	18·3	21·3	..	10·
Hurricane deck	22·3	23·6	25·	23·8	22·5	23·	19·5	24·5	27·	26·5	27·	26·5	30·	..	21·
Skylight deck	25·9	26·1	27·7	26·	25·2	25·5	22·	28·7	31·2	29·	29·5	29·8	34·2	..	23·
Pilot house	45·1	46·3	46·1	45·7	45·4	45·8	40·5	48·6	50·4	49·5	50·1	43·8	56·7	..	32·5
Wheel house	26·7	30·7	30·3	30·8	28·4	32·0	24·2	29·5	32·3	30·2	34·5	32·	41·5	..	24·

Cross braces	28·7	..	27·7	34·1	26·8	26·7	43·5	29·5	..	29·5	32·	30·8	38·2	..	25·3
Hog chain braces	..	51·4	..	52·4	..	..	..	..	..	..	..	..	..	..	..
Paddle Wheels—															
Diameter	25·	29·5	30·	31·3	30·	32·6	26·	27·5	30·	30·	30·	30·	40·	22·	25·
Diameter of shaft	1·	1·3	1·3	1·4	1·3	1·3	..	..	..	1·3	..	..	1·5	..	..
Length of bucket	11·3	11·4	12·	11·5	12·	11·	12·	14·7	12·	14·	15·	16·	12·2	8·3	7·
Width of bucket	2·	2·2	2·7	2·6	2·5	2·3	2·6	3·	3·	2·5	2·3	2·5	2·4	2·2	2·
Number of sets of arms	16·	20·	19·	20·	18·	18·	18·	18·	18·	18·	20·	18·	26·	15·	14·
Revolutions per minute	22·	20·	19·	18·	19·	18·	19·	16·	18·	20·	18·	16·	16·	24·	23·
Chimneys—															
Centre of flues ab. surf. water	9·7	9·5	9·5	10·	9·7	9·8	8·1	8·6	9·5	8·6	9·2	9·8	12·	8·2	8·3
Hinges " "	54·5	59·	27·	26·8	64·	28·9	53·7	..	..	..	..	..	..	..	23·6
Top of, " "	66·7	71·5	77·5	74·8	74·	84·7	63·7	72·7	79·8	85·8	87·5	73·8	90·4	56·	55·6
Top of, above flues	57·0	62·0	64·0	64·8	64·3	66·9	55·6	64·1	66·3	77·2	76·3	64·0	78·4	47·8	47·3
Distance between chimneys	..	18·5	18·	..	..	17·8	15·3	..	..	..	..	..	..	..	..
Diameter of	3·66	4·55	4·96	5·50	4·45	4·45	4·5	4·6	4·85	4·75	5·	5·1	5.	..	3·55
Width of iron rings	2·04	2·07	2·17	2·06	2·04	1·75	2·0	2·0	2·0	1·92	2·	1·83	2·0	..	3·56
Boilers—															
Number	4·	5·	4·	5·	5·	4·	5·	6·	5·	5·	6·	6·	6·	2·	3·
Length	26·2	26·5	30·8	30·2	30·	28·	27·	32·	30·	34·	31·	32·5	30·	26·	22·
Diameter	3·08	3·33	3·45	3·5	3·37	3·33	3·42	3·33	3·33	3·5	3·5	3·5	3·5	3·5	3·33
Distance from centre to centre	3·7	4·	4·1	4·2	4·2	4·1	4·	3·7	4.	4·	4·2	4·2	4·1	4·	4.
Number of flues	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·
Diameter of flues, inside	1·08	1·29	1·45	1·45	1·33	1·27	1·17	1·17	1·33	1·33	1·21	1·25	1·33	1·33	1·25
Draft space, back end	0·83	0·70	1·00	0·75	0·90	1·00	0·90	0·92	0·75	0·75	..	..	..	0·83	0·46	..	..
Draft space, over bridge	0·42	0·42	0·5	0·64	0·60	0·58	0·50	0·50	0·70	..	..	..	0·83	0·46	..
Pressure of steam, in lbs.	150·	140·	140·	140·	150·	150·	150·	130·	160·	145·	140·	125·	125·	135·	130·
Heaters—															
Number	1·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	1·
Diameter	2·	2·7	2·9	2·9	2·7	2·3	2·5	1·7	2·	2·5	2·3	2·	2·9	1·5	2·2
Length	4·	8·2	8·2	10·5	10·2	8·3	7·5	6·	6·	6·	8·	8·	8·	5·	6·3
Grate Bars—															
Length	4·	4·	4·	4·1	4·1	4·	4·	4·	4·	4·	4·1	4·1	4·	4·1	4·
Thickness	0·07	0·06	0·06	0·08	0·09	0·07	0·07	0·12	0·12	0·17	0·11	0·17	0·06	0·17	0·12
Spaces, width of	0·07	0·07	0·07	0·08	0·08	0·07	0·16	0·08	0·08	0·06	0·08	0·06	0·06	0·11	0·08
Depth of, below boiler	1·75	1·54	1·62	1 58	1·50	1·67	1·67	1·83	1·67	1·67	1·83	1·75	2·	1·04	1·67

PARTS MEASURED, in feet, and in decimals of a foot.	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Engines—															
Number of cylinders .	4·	2·	2·	2·	2·	2·	2·	2.	2.	2·	2·	2·	2.	2·	2·
Diameter of do. . .	1·33	2·19	2·12	2·42	2·33	2·	2·33	2·50	2·17	2·21	2·08	2·50	2·50	1·42	1·46
Length of stroke .	7·	8·	8·	8·	7·50	7·	8·	8·	9·	9.	10·	10·	10.	5·50	7·
Cuts off at . . .	5·25	4·	3·5	5·	4·6	3·5	5·	4·	6·75	5.	6·25	6·25	6·25	2·75	4·38
Length of connecting rods	24·	26·	26·	26·	26·	26·	24·	26·	27·	29·	30·	30·	35·	20·	22·
Size of steam ports, in sq. ft.	..	..	..	0·2552	..	..	0·1872	..	..	..	..	..	0·3886	..	·1512
" escape ports .	..	..	..	0·3984	..	..	0·2988	..	..	..	..	..	0·4814	..	·1800
Diameter of steam valves .	0·33	..	..	0·56	0·50	..	..	0·58	0·62	0·54	..	..	0·71	0·33	..
" escape valves	0·46	..	..	0·62	0·58	..	..	0·67	0·71	0·62	..	..	0·79	0·43	..
" steam pipe .	2·	2·	2.	..	..	..	..	..	..	..	..	..	..	..	..
" branch pipes	0·40	0·67	0·56	0·65	0·65	0·50	0·65	0·65	..	0·67	0·67	0·70	0·67	0·34	0·50
" exhaust pipe	1·00	0·90	1·10	1·10	1·10	0·80	1·10	1·00	1·00	0·9	1.00	1·20	1·00	0·50	0·80
Engines to work pumps—															
Diameter of cylinder .	0·75	1·00	..	0·75	0·75	0·92	0·67	0·75	0·75	0·67	0·75	0·50	0·92	0·58	0·58
Stroke of do. .	2·00	1·50	..	1·83	1·50	1·25	1·83	1·42	1·75	1·42	3·00	1.58	2·25	1·25	
Number of cold water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·54	0·50	0·48	0·42	0·58	0·44	0·46	0·67	0·46	0·58	0·33	0·37
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1.00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Number of hot water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·50	0·50	0·48	0·42	0·33	0·42	0·37	0·37	0·33	0·50	0·29	0·29
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1·00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Fuel consumed per trip—															
Coal, bushels . .	3200	4000	3000	4000	3000	3000	2500	..	..	..	..	..	..	100.	
Wood, cords . . .	None.	50	72	50	60	20	80	..	..	660					
Average speed—															
Passage down, hours .	36	36	36	30	42	38	40	9	10	132	144	..	..	3	
Passage up, do. .	52	52	52	50	52	52	52	15	15	132	144	..	..	3	
Against four mile current .	10	10	10	12	9	10	10	10	12	12	11	..	..	7	
Time boat commenced running	1848	1846	1850	1850	1848	1850	1847	1848	..	1848	..	..	1850	..	1850
Tonnage, carpenter's measur't	452·1	525·8	516·4	617·2	526·0	535·3	429·1	594·1	..	481.	710·	686·4	918·4	241·2	216·9

Sectional area, in sq. feet—															
Of immersion when light	96·4	107·6	94·1	102·7	82·85	..	94·0	..	..	153·9	123·3	..	150·0	46.6	68·7
Of two chimneys	20·82	32·24	38·32	47·00	30·82	30·82	31·38	33·10	36·66	34·70	38·64	40·36	..	..	19·58
Of all the flues	7·36	13·00	13·20	16·70	13·90	10·08	10·80	12·96	13·90	13·90	13·80	14·76	16·68	5·56	7·38
Over bridge wall	17·06	22·72	20·25	26·95	..	22·73	..	28·12	24·62						
Area in square feet, of—															
One bucket of wheel	22·66	25·69	33·00	30·70	30·00	25·63	32·04	44·25	35·04	35·00	34·95	40·00	29·64	19·16	14·16
Grate surface	59·2	80·	65·6	86·1	86·1	65·6	80·	88·8	80·	80·	93·32	93·32	98·40	32·80	48·
Spaces in grate	28·36	41·64	36·25	41·16	39·11	..	53·9	23·92	30·93	20·52	41·41	25·66	47·80	12·02	18·13
Whole heating surface	1343·	1927·	1935·	2394·	2270·	1614·	1887·	2649·	2218·	2560·	2667·	2839·	2716·	786·	947·
Contents, cubic feet—															
Between grate bars and boilers	127·	160·	137·	176·	173·	139·	170·	199.	170·	173·	238·	230.	243·	46·	99·
Boilers, for water and steam	569·	775·	718·	914·	889·	669·	919·	1217.	858·	1125·	1320·	1353·	1191·	347·	398·
Ratio between—															
Buckets & immers'n of vessel	2·13	2·09	1·43	1·67	1·38	..	1·47	..	..	2·20	1·76	..	2·53	1·22	2·43
Grate and effective heating surface	1 to 14·80	1 to 15·54	1 to 18·90	1 to 17·84	1 to 16·92	1 to 15·91	1 to 15·47	1 to 19·49	1 to 17·82	1 to 20·79	1 to 16·96	1 to 17·99	1 to 17·92	1 to 15·55	1 to 12·77
Contents of boiler and effective heating surface	1 to 1·53	1 to 1·60	1 to 1·73	1 to 1·68	1 to 1·64	1 to 1·56	1 to 1·35	1 to 1·42	1 to 1·66	1 to 1·48	1 to 1·33	1 to 1·37	1 to 1·48	1 to 1·47	1 to 1·54
Distance traversed by hot air and gases	107·	112·	123·	122·	121.	120·	107·	125·	123·	142·	135·	126·	135·	97·	88·
Fuel consumed in pounds of coal and its equivalent in wood,															
Per hour	2545·	3892·	3409·	4281·	3032·	..	2989·	..	..	3125·	..	..	..	1166·	
Per second	0·71	1·08	0·95	1·19	0·84	..	0·83	..	..	0·87	..	..	..	0·32	
Per hour on each square foot of grate surface	43·	48·65	51·97	49·72	35·22		37·37	..	..	39·06	..	..	..	35·57	
Nominal horse power of all the engines—															
At 100 lbs. steam, per inch	800·	781·	659·	928·	866·	514·	913·	816·	895.	927·	862·	1104·	1104·	267·	378·
At pressure of steam, stated by engineer of boat	1200·	1093·	922·	1300·	1212·	720·	1279·	1060·	1432.	1344·	1207·	1324·	1380·	360·	491·

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 284.

Improvements in Electro-Telegraphic Apparatus and Machinery. Wm. Thomas Henley, and David George Foster, of Clerkenwell, London, January 10th, 1849.—The invention consists, *Firstly*, in certain improved arrangements of electric apparatus, whereby a visible index hand or pointer is directly acted upon by a single magnet suspended within the sphere of influence of an electro or other magnet, having each of its extremities converted or resolved into two or more poles.

Secondly, Our invention consists in keeping the magnetic bar, needle, or pointer in one position for any length of time, or imparting to such bar, needle, or pointer, any number of distinct deflexions or movements, by means of the current or currents derived from magneto electricity, and also in making use of the residual magnetism to act upon the needle on its return to its stationary position, instead of the force of gravity; that is to say, in moving the needle in one direction by the induced current, and bringing it back to its stationary position by the action of the reversed inductive current, whereby the motions of the needles are increased in rapidity, and rendered much more marked and distinct than heretofore.

Thirdly, Our invention consists in certain improved arrangements of the magneto-electro apparatus used in electric telegraphs, whereby two distinct currents may be derived from the same magnet, and the reversed current can be made of equal intensity with the primary induced current, and single or double currents may be sent, as required, through any required number of instruments at different stations.

Fourthly, Our invention consists in the improved apportionment of the signs or symbols used in electric telegraphs. [The object of this new apportionment is to reduce the number of movements requisite, and it seems very successfully carried out. We pass over the details, which would occupy more space than we can afford to them.]

Fifthly, Our invention consists of an improved compound of gutta percha, suitable for the insulation, covering, and exterior protection of wire and other metallic substances employed to transmit currents of electricity. We mix the gutta percha nearly in equal portions, by weight, with sand which has been ground or pounded to a degree of fineness exceeding that of the finest natural sand, or with the siftings of glass paper manufactories, or glass fragments and particles of any sort, reduced to a similar degree of fineness, and this either by mixing the pulverized sand or glass with the gutta percha in a state of solution, or while in a plastic state.

Sixthly, Our invention consists in the employment of a current reverser of a peculiar construction, whereby we are enabled to dispense with the use of magneto apparatuses for the purpose of deriving currents of electricity in the manner before described, and to substitute in lieu thereof, voltaic batteries, such as are commonly in use for the purpose of transmitting currents of electricity along metallic conductors, such reverser

completing the circuit twice during its motion, by the transmission of a reversed current, in the manner of the magneto machines.

Seventhly, Our invention consists in the employment, in manner following, of currents of electricity to regulate and govern the motions of time-keepers, whether the same be influenced by a current from a distant station or otherwise. We make use for this purpose of the currents of either magneto or voltaic electricity; but obtained in the latter case without the aid of soft iron from two hollow coils of insulated wire affixed to the pendulum of the regulator, and surrounding the poles of two permanent horse-shoe magnets, which coils vibrate in the direction of their length alternately, off one pole on to the other, a current being induced at each vibration, but in opposite directions.

Claims.—1. We claim in respect to electric telegraphs, and to all machines or machinery, to the moving of which electricity is or may be applied, the different arrangements of apparatus described under the first head of this specification, in so far as respects the division of each pole of the magnet into two or more poles, and the direct action on the index hand or pointer, or other recipient of the magnetic influence.

2. We claim the mode of causing the index hand or pointer to be permanently deflected (that is, for any length of time required) in one direction, and bringing it back by the reversed current to its original stationary position, and keeping it there, as before described.

3. We claim the three several magneto-electric apparatus described under the third head of this specification, in so far as regards the peculiar arrangements and combinations, whereby two distinct currents are obtained from the same magnet, the reversed current is obtained of equal intensity with the primarily induced current, and either single or double currents may be sent as required through any number of instruments at different stations.

4. We claim the improved system of visible symbols suitable for electric telegraphs, before described and exemplified.

5. We claim the employment in electric telegraphs, and in all other machines and machinery to the moving of which electricity is applied, of the peculiar compound of gutta percha, before described, for purposes of insulation and protection.

6. We claim the improved current reverser, before described, in so far as respects the effecting by a single depression of the lever or key, the completing, reversing, and breaking of the electric current.

7. We claim the application of currents of magneto-electricity to regulate the motion of time-keepers in the peculiar manner described under the seventh head of this specification; that is to say, in so far as regards the obtaining of the currents from the inductive action of permanent magnets and coils of insulated wire without the aid of soft iron. And,

8. We claim the application to the regulating of time-keepers of currents of electricity (whether magneto or voltaic) transmitted from a primary or standard clock by the improved apparatuses and instruments, and by the peculiar modes before described, that is to say, in so far as regards the alternate transmission of the current in opposite directions, and the different mechanical arrangements whereby that is effected.—*London Mech. Mag., Vol. L, p.* 148.

Henley's Magneto-Electric Telegraph.—An experiment has been made under the direction of the French Government, to test the efficacy of Mr. Henley's Magneto-Electric Telegraph, which is worked without batteries of any kind, and at a fraction of the cost of the voltaic system. The line of railway assumed for the trial was that from Paris to Valenciennes. The persons present at the two stations were, the director of the French telegraph, a Commissioner appointed by the Belgian Government, and a few others. The distance is 180 miles, being the longest telegraph line in France. After a most satisfactory series of trials on the single distance, first with full power, and afterwards with one-twentieth of the power, the wires were connected so as to treble the total length of wire, making 540 miles to and from Paris and back; the magnetic message being communicated through the first wire, back by the second, through the third, and back again by the earth. It was not anticipated that the magnet could possibly work through this resistance; but in fact, it is alleged it was worked as directly and rapidly as when only made to traverse the 180 miles with full power. The ordinary telegraph, with battery power, used by the French Government, was then put in requisition, but not the slightest effect was produced. On the single distance even, a signal was not obtained for several minutes, owing, it is said, to some fault in the batteries. The Government officers and others inspecting the working operation, expressed themselves thoroughly satisfied with the series of trial.—*London Mining Journal*, 1850.

Highton's Improvements in Electric Telegraphs.—On February 7, 1850, Mr. Edward Highton, Engineer, Middlesex, England, patented the following arrangement of telegraphic circuits: "Two or more signalizing instruments, and to each instrument two batteries are connected, so placed in regard to their poles as to work in opposite directions. A method of working electric telegraphs by the inductive influence of electro-magnets, making the dials, which carry the letters or characters, movable, instead of the pointers. As many of his claims are old, I only notice such as are important: he incloses his wires in flexible materials, such as lead; this was done in 1844, by Prof. Morse. The protecting the telegraphic wire by enveloping them in masonry; also, enameling the exterior surface of gutta percha coating of electric wires by rubbing the surface over with naphtha, or other solvents, and then smoothing it down by a cushion or brush.

A method of constructing the supporting posts out of a number of planks firmly united together, instead of out of one piece of timber, cut taperingly, as has hitherto been the custom.

Removing the atmospheric electricity which is collected during storms or other atmospheric disturbances, by causing the line wire, or a bar of iron connected thereto, previously enclosed in bibulous paper, or other fabric, to pass through a mass of iron filings.—*London Mech. Mag., No.* 1413, *Sept.* 1, 1850.

Brown and Williams's Improvements in Electric and Magnetic Telegraphs, March 17, 1850.—The only new claim is a method of protecting the conducting wires of electric telegraphs by strands of hemp put on by a braiding engine, and then coating the whole by gutta percha. And a method of connecting the transmitting wires by screwing one end of a

wire into a nut formed on the corresponding end of the next wire.—*Lond. Mech. Mag., March* 7, 1850.

W. S. Thomas's Improvements in Electric Telegraphs, patented Feb. 12, 1850. *Claim.*—What I claim as new is, the making of signals or marks for telegraphic purposes, by the agency of heat generated, induced, or controlled by a current of electricity passed along attenuated conductors, wires, or points; the signals being the flashes of light emitted by the heated conductor or points, are manifest to the eye of the operator; the marks being produced on the paper by the heated point or conductor are the record of the message.—*Journ. Frank. Inst., Sept.* 1850.

Mr. J. L. Palvermacher, C. E., of Vienna, Improvement in Galvanic Batteries, in Electric Telegraphs, and Electro-Magnetic and Magneto-Electric Machines.—I only notice his improvements in electric telegraphs, that is to say, in so far as regards, 1st, A method of varying the intensity of the current, either by increasing or diminishing the number of elements employed, or by interposing more or less powerful resistance to the current. 2d, The imprinting letters or signs by one completion of the current. 3d, The substitution of a letter cylinder for the letter wheel ordinarily employed, and a method of arranging the letters and signs on each cylinder. 4th, The application of a double escapement, each capable of assuming four directions, and each producing effects different from those produced by the others. 5th, The employment of four electro-magnets, to act on two soft iron bars, and thereby render a weak galvanic current, available in two directions, and productive of two separate and distinct effects. And, 6th, The method of gradually detaching the keeper from the electro-magnet, by causing the springs which act upon the keeper magnet, to come only successively into operation.—*Lond. Min. Journ. Vol. XX, p.* 323, *July*, 1850.

Mitchell's Electric Telegraph.—At a recent meeting of the Philosophical Society of Glasgow, Alexander Mitchell, in a lecture on the electric telegraph, introduced some improvements stated to have been made by him in the general arrangement of the instrument, in the use of only one wire, and in the great facility by which the instruments can be worked. As given in a Glasgow paper, it appears that letters are arranged in a segment in front of the operator, and corresponding ones inscribing on keys similar to those of a piano-forte. On pressing down a key, the corresponding letter is immediately pointed to by a needle, a similar movement taking place at every station throughout the circuit. We know not if Mr. Mitchell was the first constructor of this kind of telegraph, but we do know that a similar one was exhibited two years since at the Society of Arts; and we also know that several inventors of telegraphs have been content to use only one wire, employing the earth for the return circuit.—*Lond. Mining Journ. Vol. XX, April* 13th, 1850.

Austin F. Park's Improvements in Electric Telegraph Manipulators, Troy, New York, August 27, 1850.—"The nature of my invention consists in arranging machinery for closing and breaking an electric telegraph circuit in transmitting intelligence, whereby the operator, by giving a finger key one instantaneous touch, as distinguished from the prolonged touch applied to the key in ordinary machines, closes and breaks the

electric circuit, at and during such time as is required to signal or record a telegraphic sign for a letter, figure, or other character."—*Journ. Frank. Inst., Vol. XX, p.* 245.

The machine is stated to be ingenious, but unfortunately it is too complicated; the advantages of its use are to prevent mistakes from being made by telegraphic operators. I have not given the claims, as it could not be understood without a drawing.

Charles S. Bulkley's Improvements in Repeaters for Electro-Magnetic Telegraphs, Macon, Bibb Co., Georgia, Nov. 12, 1850: *Claim.*—"What I claim as my invention is, the manner of connecting two galvanic circuits with the two electro-magnets, (*a a*, and *d d*, in the said repeater,) each of the said galvanic circuits, as it passes through my said telegraphic repeater, embracing in its course the armature of the opposite electro magnet, in the said instrument, previous to its passing through the helices in the electro-magnet, embraced in its own respective circuit.

"In combination with the above, I also claim the connecting the points with the galvanic battery (or batteries), when the said points are placed in such positions in relation to the armatures of the electro-magnets in my said telegraphic repeater that when either one of the said electro-magnets is charged, it will, by attracting its armature against one of the points *l* or *i*, close the poles of the galvanic current in which the opposite electro-magnet (in the instrument) is in connexion, and thereby throw the battery into said circuit."—*Journ. Frankl. Inst., Vol. XXI, 3d series.*

The object of this repeater is for the purpose of repeating or recording a communication in several places at once along a line, and at the same time allowing the galvanic circuit to remain open when the line is not in use.

Siemens' Improvements in Electric Telegraphs.—Ernst Werner Siemens, of Berlin, patented in England, April 23, 1850, the following improvements: *Claims.*—"1st, The constructing electro-magnets for telegraphic purposes, of longitudinally divided tubes of iron or other magnetic metal, or of bundles of wire of iron or other magnetic metal.

"2d, The construction of instruments, for obtaining motion for telegraphic purposes, by means of one or two-electro magnets revolving on their axes within the fixed coils, by which they are rendered magnetic, or mounted on a transverse axis, and vibrating from side to side within the coils, by which they are magnetized.

"3d, The construction of instruments for producing motion for telegraphic purposes by means of metallic spiral coils or bands traversed by electric currents, and attracting or repelling each other; also producing motion in such spirals by the proximity of permanent magnets, which at the same time serve to produce electric currents by induction for working telegraphic apparatus.

"4th, The construction of the conducting contact pieces of alloys of platinum, iridium, or palladium with gold or silver, whether such alloys be further alloyed by the admixture of other metals or not.

"5th, The construction of electric telegraphic printing apparatus in such manner that the magnet which works the step by step motion, breaks and restores the circuit by the oscillation of the armature, or of the moving magnet itself.

"6th, The combining of electric telegraphic printing apparatus in the

same circuit with indicating apparatus, when the magnets which work the step by step motion of either or both instruments break and restore the circuit by the oscillation of the armatures, or of the magnets themselves.

"7th, The impression of the types on the paper at the instant that the type-wheel stops, by arranging the electro-magnet which acts on the hammer, so that the short intermittent currents which work the electro-magnet of the type-wheel traverses the coils of this magnet without producing motion of the armature, which, however, is set in motion when the current is rendered continuous by the stoppage of the type-wheel.

"8th, The arrangement of the magnet which acts on the hammer in electro-telegraphic printing apparatus, so that its own circuit is broken by the magnet itself towards the end of its stroke.

"9th, The arrangement of apparatus in electric printing apparatus in such manner that the printing is effected by pressing the type against paper, in contact with an inked roller.

"10th, An arrangement for retaining the moving piece which breaks and restores the electric circuit in its respective positions.

"11th, The application of a small pin for preventing the overrunning of the ratchet-wheel in electric telegraphic apparatus, with the step by step motion.

"12th, The arrangement of a transmitting apparatus with an indicating or printing electric apparatus worked by step by step motion, or with both together, in such manner that the transmitting apparatus breaks and restores the circuit of the telegraphic apparatus, which reciprocally breaks and restores the circuit of the transmitting instrument.

"13th, The combination of a self-acting alarum, with a transmitting apparatus.

"14th, The combination of a self-acting alarum with a transmitting instrument, which breaks and restores the circuit of the alarum magnet, which in its turn reciprocally breaks and restores the circuit of the transmitting instrument.

"15th, The combination of one or two cylinders carrying pins, with a series of springs and keys, for making contacts for transmitting a distinct determinate succession of electric currents in one or both directions by the depression of each key.

"16th, The employment of an implement of the nature of a plough, and revolving cutters for making trenches or channels to receive underground line wires.

"17th, The application of the propelling power of a locomotive engine to giving motion to such implements.

"18th, Conducting under-ground line wires into the ground, by means of suitable guides, which either form part of, or immediately follow, the cutting instruments.

"19th, The following improvement in the manufacture of coated wire for electric telegraphic purposes: first, an arrangement of machinery for coating the wire, with two cylinders and pistons, by which the pressure of the semi-fluid mass against the wire is equalized; 2d, arranging these cylinders, (or cylinder when only one is used,) so that they may be removed and replaced by others, while the former are being discharged;

and 3d, the consolidating of gutta percha, or its compounds within these cylinders in vacuo.

"20th, The testing of coated wire for telegraphic purposes, by passing it through water, with which is connected an apparatus capable of producing electric shocks, so that the circuit may include the person of the operator, and may be completed by the passage of the electricity through the defects in the coating in the wires.

"21st, The covering of insulated under-ground line wires with strips of sheet lead.

"22d, Establishing a direct communication between under-ground line wires and the earth, by means of a thin wire of German silver, or some other imperfectly conducting substance, so that the resistance to the passage of the electricity may be capable of being regulated at pleasure. *London Mechanics' Magazine, No.* 1421, *Nov.* 2, 1850.

An interesting report of M. Siemens' telegraph to the Academy of Science, Paris, will be found in vol. xxi, Third Series, of this Journal, p. 209 and 255-15, 1850.

The commission conclude their report of M. Siemens' apparatus in the following words: "The commission have examined M. Siemens' apparatus with great interest, and remarked throughout, an evidence of a perfect intelligence of the theory, as M. Siemens appears to have taken into account all the complicated phenomena which are manifested in the conductors and electro-magnets, especially when the actions are of short duration.

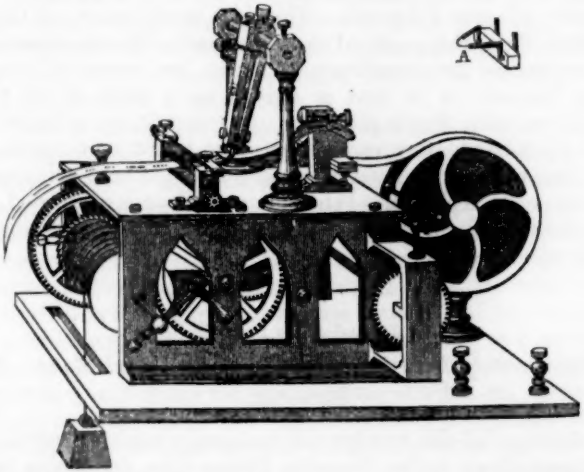
M. Siemens' system, if worked with care and attention, appears to possess incontestible superiority over all other apparatus of the like nature, that is to say, the ordinary arrangement of alphabetic apparatus; as the latter do not work with the same degree of precision and accuracy. With regard to speed, the commission are led to believe that M. Siemens' apparatus surpasses all other alphabetic apparatus; their opinion is, also, that M. Siemens' improvements in the construction of electro-magnets will prove advantageous.

Horn's Igniting Telegraph, patented June 25, 1850.—The register invented by G. H. Horn, of Boston, employs a principle, namely, the heating or igniting effect of electricity. When an electrical current flows through a fine platinum wire it ignites it, or brings it to a red heat. If this wire is bent, as at A, in figure 55, so as to be in contact, for a short distance, with a moving fillet of paper, it will burn a hole through the paper when the current passes. This can be done with great rapidity, so as to represent probably a hundred linear letters per minute.

This instrument, the greater part of which consists of the clock-work, spool, &c., required for moving the paper. Above the clock-work are two pillars, supporting an axis, upon which is the adjustable wire-holder, the lower extremity of which is seen touching the fillet of paper. By means of the connexions and insulations of the pillars, axis, and wire-holder, the platinum wire, which passes over a little slip of porcelain at the end of the wire-holder, becomes part of the circuit, with which the two screw-cups on the right of the base-board are connected. When the wire needs adjustment, the wire-holder can be turned up on its axis.

The bed supporting the fillet of paper is also adjustable, so as to regulate the contact between the wire and the paper.

Fig. 55.



This register requires a quantity current to produce the effect of ignition, and therefore needs a receiving instrument and local battery, to be operated by the telegraphic circuit.—*Book of the Telegraph, p.* 37.

This telegraph is the same in principle with that patented by Wm. S. Thomas, Feb. 13, 1850.

Before concluding these lectures I will here notice two telegraphs which I have omitted in their regular order, and first of

The Telegraph of Brett and Little of London.—The magnet employed in this telegraph is in the form of a ring or horse-shoe, and is suspended in the centre of helices of copper wire, which are double and of a circular form. This magnet is deflected either to the right hand or to the left, according to the direction of the current. The indicators are not magnets, but are moved by the agency of the magnets, by which a distinct and certain indication is insured.

Another modification of this instrument has been made by Mr. Little, which is as follows: the patent instrument is of the form of a disk of mahogany, about 1 foot high by 8 inches broad, standing in a vertical position on a pedestal; the only appliances at the back being the metallic buttons, or binding screws, necessary to convey the galvanic fluid from the battery to the indicators. Two tubes of glass about one-fourth of an inch in diameter, and 3 inches high, are placed in front of the disk, with the alphabet engraved on a metallic plate placed between them, with the number of deflexions required to express each letter, stated in plain figures. On the top of each of these tubes, which contain spirits of wine, is a small but powerful cylindrical magnet about one-fourth of an inch in diameter, from the bottom of which are suspended by magnetic attraction, two needles with the points upwards.

On completing the galvanic circuit, these needles are deflected with equal rapidity with one on an axis; and on breaking connexion, the needle

is instantly arrested in its fall to the perpendicular by the density of the fluid, with almost as dead a stop as the seconds hand of a watch, avoiding the vibration so annoying in the old system, which tends so much to puzzle and mislead.—*Lond. Mining Journ., Vol. XXI, p.* 183.

Bakewell's Electric Telegraph.—This is a modification of the instrument of Alex. Bain, Esq., noticed under the head of Electro-chemical Telegraphs, employing the same chemical agent, but instead of holes cut in paper, the message to be sent is written on a sheet of tin foil with sealing wax varnish; this is placed on the transmitting cylinder; all the lines of the non-conducting varnish serving to break the connexion. On the receiving cylinder, a sheet of paper moistened with acidulated ferro prussiate of potash is placed. When the connexion is completed, electro-chemical decomposition is effected; and where any interruption occurs, no change takes place.

For the Journal of the Franklin Institute.

On the Steamboats of the Western Waters of the United States. By J. V. Merrick.

In another part of this number will be found a table extracted from the report of proceedings in the Wheeling Bridge Case, containing (what are believed to be) reliable data respecting some of the steamboats now running on the Ohio and Mississippi rivers. An examination of some of the details of this table will show conclusively a very curious fact respecting the practice of Western engineers, which, although it may before have been noticed, has been hitherto overlooked, or ignored in the construction of their machinery.

The Western steamboats are made on a peculiar type, which is to be found principally in that section of the country, and whose existence at this stage of improvement in river navigation only serves to show how far prejudice, and a spirit of servile imitation, can prevent advances dictated by science, or by successful experience elsewhere. They are, with but trifling exceptions, propelled by a pair of high pressure inclined engines, bolted to timber frames, and with very long wooden connecting rods; each engine being attached independently to its own wheel. They are placed on deck, (which is within two or three feet of the surface of the water,) and with the boilers occupy from one-third to one-half the length of the boat, and the whole breadth inside the wheel-houses. The valves are of the description known as "poppet," which till within a very recent period were made single, and required considerable power to work them, but are "double" (or balanced) on the new engines. Steam and exhaust valves are worked by separate cams attached to their respective rock-shafts; provision is made for connecting these shafts when it is desired to work full stroke, but the cut-off is not adjustable. Each valve is lifted by a lever, in the usual "safety valve" style, which lever stands parallel to the cylinder, and covers the tappets on the rock-shafts; the latter, of course, crossing the cylinder near the middle of its length. The valves are not allowed to lift high enough to give an area of passage equal to their own, which in itself is usually smaller than given by the usual English and our own Eastern practice.

The boilers are cylindrical, with two flues; are set in brick work, and

placed upon the deck forward of the engines; furnaces forward; and the flame, &c., passing under the shells to the after end, returns through the flues. It is the universal custom to carry steam of a very high pressure in the boilers, a circumstance which has now become a sort of proverb, and the results of which, combined occasionally with those of an opposite error in respect to the water level, may be found in the records of steamboat disasters in the United States, and present a lamentable instance of reckless disregard for the safety of human life.

The object of the present article is to show that this high pressure, with all its attending evils, is entirely unnecessary; and it is to this "curious fact," before adverted to, that it is now desired to call attention.

The application of an indicator to any of these engines would demonstrate this point; but as such attachment has not been made, so far at least as I am aware, recourse must be had to another method of proof.

The economical efficiency of a boiler depends on the relative proportions of its effective heating surface, grate surface, and least cross section of flues or chimney, and the rapidity of combustion, or consumption of fuel. The greater the rapidity with which combustion is carried on, the less perfect is it, and hence the less economical will it be. Hence, (within certain limits,) that boiler which burns least fuel *per square foot of grate*, in a given time, or, in other words, which has a larger grate to burn the same fuel, evaporates the greatest amount of water by the combustion of a pound of fuel. That boiler which presents the greatest extent of effective heating surface to the action of the combustible, will, of course, draw from it the greatest useful effect with a given velocity of draft. Finally, the less the velocity of draft requisite, the greater useful effect will be obtained, since the products of combustion have more time to communicate their heat.

To compare, then, the circumstances attending the consumption of fuel with those of other instances, I shall take an average of five western packets, (in order to obtain a mean result,) and compare it with some steamer whose consumption per square foot of grate is about the same as theirs.

On referring to Bartol's *Marine Boilers*, we find that the steamer *Mayflower*, running on Lake Erie, consumes 6160 pounds of bituminous coal per hour, on a grate of 151 square feet, or 40·8 pounds per square foot per hour; total heating surface, 4791 square feet, or ·778 feet of surface per pound of coal per hour; useful effect produced, 5·94 pounds of water per pound of coal.*

In the five packets before alluded to, and which are hereafter specified by name, the average consumption of fuel is 3254 pounds of bituminous coal or its equivalent per hour, on a grate of an average area of 79·2 sq. feet, or 40·87 pounds per square foot per hour; total heating surface averages 1940 square feet, or ·596 feet of surface per pound of fuel per hour; being but ·766 that of the *Mayflower*.

The velocity of draft under these circumstances, since the same quantity of coal is burned per square foot of grate, would depend on the rela-

* The author states it at 6·3 pounds, but informs us at the end of the work, that this is based on the supposition that there is no difference between boiler and cylinder pressure; assuming this at 2 pounds, which may be called a minimum, 5·94 is the real coefficient.

tion between the respective areas of flue and grate. In the five packets it is as follows:—

	Consumption of bituminous coal per hour pr. sq. ft. grate.	Ratios of areas of grate to flues.
Clipper, No. 2,	43·00	1 to ·1250
Hibernia, No. 2,	37·37	1 to ·1336
Bostona,	39·06	1 to ·1780
Buckeye State,	49·72	1 to ·1830
Messenger, No. 2,	35·22	1 to ·1654
Mean,	40·87	1 to ·1570

Or an average ratio of 1 to ·1570, while in the *Mayflower* it is 1 to ·1780; whence it follows that to allow the same amount of air, &c., to pass, the velocity required in the western boats must be to that in the boiler of the *Mayflower* as 1·134 to 1·000, and hence that in the latter case more useful effect would probably be obtained from the fuel.

Finally, the boiler of the *Mayflower* is a single "rising flue," while those of the western boats are cylindrical, and it is known that in the latter form, the proportion of *effective* in the total heating surface is less than in the former. Since, then, all the circumstances are concurrent to more perfect combustion in the boiler of the *Mayflower*, and since in that case the useful effect is as 5·94 to 1, it appears that from 4½ to 5½, to 1 will be a fair allowance as a *maximum* effect in the western boats. In order to allow for the difference in temperature of the water entering the boilers, and to insure a perfectly fair comparison, I shall employ in it the higher number or 5·5 pounds of water to a pound of fuel, as the maximum useful effect.

Having determined this point, it remains to show that with this *maximum* of evaporation, it is impossible to produce a volume of steam sufficient to fill the cylinders, at their point of cutting off, and number of revolutions per minute, with steam of any thing like the pressure carried in the boilers.

Referring to the table, we obtain the following calculation, which is tabulated for comparison:

	Names of Packets.	Space displ'nt of piston for each double stroke at point of cutting off.	Revolutions per minute.	Consequent volume of steam used per minute.	Consumption of fuel per minute.	Calculated vol. water evap. at the abv. stand'rd	Ratio vol. steam to vol. water.
1	Clipper, No. 2,	58·61 cu. feet.	22	1289 cu. feet.	42·42 lbs.	3·633 cu ft.	342
2	Hibernia, No. 2,	91·66 "	19	1742 "	49·81 "	4·785 "	394
3	Bostona,	77·66 "	20	1553 "	52·09 "	4·583 "	339
4	Buckeye State,	91·66 "	18	1650 "	71·35 "	6·279 "	261
5	Messenger, No. 2,	78·59 "	19	1493 "	50·53 "	5·362 "	276
		Average,		1545 "	53.24 "	4·928 "	322·4

Giving as an average result, a volume whose corresponding pressure is 74·7 pounds above the atmosphere; while that carried in the boilers was respectively 150, 150, 145, 140, and 150; average, 147 pounds; difference between boiler pressure and maximum average cylinder pressure, 72·3 pounds.

I am not to be understood as saying that the pressure never exceeds this point; far from it; it is very possible that at the commencement of a stroke, or at some point in it, it may be higher: but simply, that the *average* pressure during the time for the admission of steam, cannot differ greatly from the one named.

It may be very true, that the consumption of fuel is, of all other data respecting the performance of an engine and boilers, the least reliable; since different firing, different qualities of coal, and differently arranged boiler surface, &c., may modify the useful effect within wide limits: but when it is considered that on the one hand, the Mayflower is a boat (running on Lake Erie) burning the same quality of fuel as the Western boats; that her consumption is the average of her running trips; that it was certainly not to the interest of the reporter to magnify that consumption, when it was known that the report was intended for publication; and, on the other hand, that an average of *five* packets, running on different routes, and supposed to have all the modern improvements, &c., was taken with an average of their running consumption through the whole trip; that it was certainly not to the interest of those reporting their performance, to name a *less* amount of fuel than the true consumption, (since, other things being the same, a diminished consumption would require a diminished height of chimney,) it is certainly, in view of these points, not possible to conceive that the maximum pressure in the cylinders as calculated can vary greatly from that actually maintained.

It will be observed that the least volume in the table just given (that of No. 4) gives a pressure of 96·6 pounds above the atmosphere; while the greatest volume (that of No. 2) gives a pressure of 58 pounds; mean, 77·3.

Why then, it will be asked, is this tremendous pressure carried, if so useless in propulsion? Among other reasons may be named; 1st, Custom and prejudice, which on the Western waters require a high pressure of steam to be maintained; otherwise the boat is not considered either fast or powerful. 2d, The absurd notion existing among a large class of their engineers, that steam has a momentum or impact, which at high pressures imparts a force to the piston over and above that due to its pressure, when considered as a compressed and elastic vapor. 3d, and most probably the principal reason; a contraction in the steam openings and pipes, which increases the friction due to the passage of steam at such high pressure, and diminishes the velocity at which it can be supplied to the cylinders, thus rendering necessary a great difference between the boiler and cylinder pressure.

If these reasons are just, the remedies are quite as plain, and need not be enlarged upon. It is easy to increase the area of passages, and insure a liberal supply of steam to the cylinders, even though such augmentation be attended with increased expense; and expense should be no object when viewed as a certain means of obviating the *necessity* for carrying this dangerous pressure of steam. Then legislative enactment must lend its aid to compel engineers to work their boilers at the minimum pressure, which, with wide throttles, will be found as efficient as the present system.

There is, therefore, no doubt that a much lower pressure of steam might with the same engines perform all that is done by the exalted pressure, now carried so universally; while at the same time the comfort,

economy, and, above all, the safety of the boats, would be vastly increased.

But there is another means of overcoming the difficulty, and of increasing the economy of these packets, viz: the employment of condensing engines, which would at once cut down the requisite initial pressure 12 to 14 pounds per square inch, and by lessening the work of the boilers, permit a more perfect combustion of fuel. And although prejudice has done its utmost to prevent, or rather to postpone, in that section of the country, this improvement, high pressure engines will as certainly be driven from the Western rivers, at some future day, as they have been from the Lakes within the past few years. Their use on Lake Erie, which was formerly the *rule*, forms now a bare exception.

For the Journal of the Franklin Institute.

On Marine Propulsion. Reply to J. V. MERRICK, Esq. *By* J. W. NYSTROM.

Mr. Merrick's "*clear case*" resembles so much the turbid water of a swollen stream, that we think it must pass through the filterer of criticism, taking for our compound the *Static* and *Dynamic momentum*.

The first point to be tested will be found on page 271. In the first paragraph, Mr. M. states that if the above is not "clear enough he will state it in another form." *No, it is not clear.*

Let the arrows *m*, *n*, *o*, figs. 1 and 2, plate V, represent the direction of motion of the centre of the paddle wheels on a steam vessel, *w*, *w*, *w*, being the load line and water in which the paddles act.

The accompanying diagram plate V, represents two different situations of the vessel. Fig. 1, the paddles take hold of a rock in the water, so that the vessel can move freely without touching the rock; then there will be no slip of the paddles, while the vessel moves the space H. Fig. 2. The paddle acts freely in the water, so that while the vessel moves the space H, the paddle moves backwards the space V, which then will be the slip. Suppose the vessel moves the same space H in a unit of time; then if slip causes a loss of effect, more power should be required in fig. 2 than in fig. 1.

First Case, Fig. 1.—The crank of the steam engine is supposed to be in the same line as the acting paddle; then the line $R + r$ will be a lever of the second kind, with its fulcrum against the rock at *c*. The letters will denote:—

r = radius of the crank.
h = pressure in the crank pin.
b = velocity of the crank pin.
R = radius of the paddle wheel.
B = resistance in the centre line of the paddles.
H = velocity of the vessel.
c = resistance against the rock.

Static momentum, .
- Action $(h + c$ = B reaction.
- B : h = (R + r) : R.

Dynamic momentum, .
- b : H = (R + r) : R.
- B : h = b : h.
- Action $h\ b$ = B H reaction.

Second Case, Fig. 2.—The crank pin moves the space W while the paddle moves the space V. There will be found a point, *c*, on the paddle arm which has no motion, and is therefore a fulcrum thereof.

I = pressure in the crank pin.
W = velocity of the crank pin.
B = resistance in the paddle journal.
H = velocity of the vessel or journal.
M = resistance of the water.
V = velocity of M.
c = resistance in the fulcrum *c*; and

$$I + \quad c = B \quad \text{of which} \quad B = I + c. \qquad (1.)$$

$$I : \quad c = S : r \quad \text{“} \quad S = \frac{I r}{c}. \qquad (2.)$$

$$V : \quad W = s : (S + r) \quad \text{“} \quad s = \frac{V(S+r)}{W}. \qquad (3.)$$

$$s M + B S = I(S + r) \quad \text{“} \quad s M = I(S + r) - B S. \qquad (4.)$$

By the insertion of the formula (3) in (4), we obtain—

$$M \frac{V(S+r)}{W} = I(S + r) - B S.$$

$$M V = \frac{I(S+r) - B S}{\frac{(S+r)}{W}} = \frac{I W (S+r) - W B S}{S + r} = I W - \frac{W B S}{S + r}. \qquad (5.)$$

By the insertion of the formulæ (1) and (2) in (5), we obtain—

$$M V = I W - \frac{W I r (I + c)}{\left(\frac{I r}{c} + r\right) c} = I W - \frac{W I r (I + c)}{I r + c r} = I W - I W \frac{r (I + c)}{r (I + c)}$$

that is to say, M V = I W − I W = 0. Or, M V is no part of I W.

We see now that M V is of no effect at all for propelling the vessel; it only serves to keep the paddle arm stationary at the fulcrum *c*, and if we examine M V without any theory, we will find that the resistance M acts *with* the vessel, but the velocity V acts *opposite* the same, and they thereby counterbalance each other, and produce *no* effect for propelling the vessel.

Let the velocity of the paddle at the circumference be J, and V a fraction thereof. The effect exerted in the water should be M J V; but if we carry M J V to the fulcrum it will be equal to 0, because V = 0, and there it will act as a resistance in marine propulsion, as the rock in fig. 1, with no effect. Then we have another lever of the second kind, with its fulcrum in *c*, which we will compare with the first case, fig. 1.

Fig. 2:—

Static momentum, . { Action I + *c* = B reaction.
B : I = (S + *r*) : S.

Dynamic momentum, { W : H = (S + *r*) : S.
B : I = W : H.
Action I W = B H reaction.

But B H = *h b*.

Therefore I W = *h b* = B H which was to be proved.

We see now that the effect given in both fig. 1 and fig. 2 is equal,

and what the velocity in the one case is greater than in the other, the pressure will be so much less, because it acts on a shorter lever. To compare this with screw propellers, let the letters represent—

R=P pitch of the propeller.

S=(P—s) as in the paddle wheel.

Then we have W : b = S : P.

With equal velocity of the vessel, the different values of the pressure W is measured by S=(1—s,) and caused by different areas of propellers. (See further respecting acting area of propellers.)

The appearance of loss of effect by slip is measured by the mass of water forced backwards;—it can be viewed in another way. Suppose a vessel runs in a canal say 1000 feet long, and has a sectional area equal to 10 of the propeller, whose pitch is 10 feet; then, when the propeller has made 100 revolutions, the vessel should run the 1000 feet if there was no slip. But suppose the slip to be 50 per cent.; then when the vessel reaches the other end of the canal, the propeller will have made 200 revolutions: that is, 100 revolutions which have propelled the water backwards; consequently, at the other end of the canal there should be no water left for the vessel to float in. But it will be found that when the vessel has passed the 1000 feet, the water is at the same height as when the vessel started from the first end. So it will be with a vessel starting from Liverpool for New York,—on reaching New York, the water will not be higher in Liverpool or lower in New York, extracting the tide. At the moment that a vessel starts, the slip is equal to the unit; if it is a measure of loss of effect, the vessel could never be started.

Mr. M. says, "And then the ratio of the coefficient * * * to the velocity of the water backward." Now, after Mr. M.'s lengthy disquisition, "that slip is no loss of effect," he comes to the conclusion of my first formula: $p\,v = r\,s$, or, as Mr. M. expresses it, $p : r = s : v$, in which

p = coefficient of the vessel.

r = area of floats multiplied by the coefficient for resistance to plane surfaces.

v = velocity of the vessel.

s = velocity of the water backwards (slip).

This is a proof that slip is *no* loss of effect. The effect delivered from the steam engine $r\,s = p\,v$ the useful effect.

After Mr. M. has embodied the formula, he condemns it as wrong, and says it should be $p = r$.

If Mr. M. had substituted *resistance* of the vessel instead of *coefficient*, it would have been all right. But this "coefficient" makes the remainder of his article wrong.

In his note Mr. M. says, "By the coefficient of a vessel, I mean that, * * * or 1 nearly." Here Mr. M. is confused in the difference between effect and pressure. When a body, P, is to be moved from its passive state, and has no other resistance than its own inertia, the *pressure*, B, which is required to give that body a certain velocity, V, in a given time, T, is

$$B = \frac{PV}{g\,T}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (1.)$$

But the *power* which is required to give the same body the same velocity in the same time, is

$$B\,H = \frac{P\,V^2}{g\,T}. \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

D = total distance which the body has moved in the time T, and

$$\text{Pressure } B = \frac{2\,P\,D}{g\,T^2}. \quad . \quad . \quad . \quad . \quad (3.)$$

$$\text{Effect } B\,H = \frac{2\,P\,D}{T}. \quad . \quad . \quad . \quad . \quad (4.)$$

To apply this to vessels, we must first suppose the vessel P to have no other resistance against B H but its own inertia; then B H would give the vessel P the velocity V in the time T, and if at the end of the time T the pressure B be taken away, the vessel would still continue with the velocity V until some resistance acts opposite her direction; but as a vessel has the additional resistance of the *water* to sustain, the effect B H will not be sufficient to give the vessel the velocity V in the time T; we therefore will find another value of B H. The letters will denote—

R = resistance of the water at the velocity V.

r = mean resistance of the water in the time T.

The effect which is required to the resistance of the water in the time T will be—

$$\text{Effect} = \frac{r\,D}{T} \quad . \quad . \quad . \quad . \quad . \quad (5.)$$

This must be added to the formula (4), so that

$$B\,H = \frac{2\,P\,D}{T} + \frac{r\,D}{T} = \frac{D\,(2\,P + r)}{T}. \quad . \quad . \quad (6.)$$

We see here that even in the time T the effect B H is, independent of $g = 32{\cdot}08$.

The time will be $T = \dfrac{D\,(2\,P + r)}{B\,H}$.

At the end of this time T, the vessel has obtained the velocity = V, the resistance of the water = R, and the equation (4) will be = 0. Then the effect which is required to keep the vessel at the velocity V will consequently be B H = R V.

We see now that the effect which propels a vessel, a uniform velocity is entirely independent of the moving mass P, and the acceleratrix g, and that the resistance R, depends on the greatest section area of the displacement, friction area, and form of the hull. The square of the velocity multiplied "by the cubic feet of water" in motion, is a measure of the effect which has given the mass of water that motion, and *not* a measure of number of pounds.

Mr. M. says: "But the projecting area acting * * * multiplied by the secant, * * * is the advance of the vessel during a revolution."

It is well known that resistance to planes in motion in fluid, can be less by moving the plane at some angle, more or less than 90° to the direction line; but I did not know that it could be greater than itself, as will be the case when multiplied by a secant, which is always greater than one. The area Mr. M. multiplies, can be increased and diminished *ad libitum*, in the same diameter of propeller. But when Mr. M. finds his secant, he adds two squares together and divides the sum by a square;

he calls that a secant = 1·40; that must be a secant = 1·40 *square radius;* then I suppose the corresponding angle will be *square degrees!* But if Mr. M. extracts the square root of his equation, he will obtain a true secant for the angle described, but then it will be my formula *turned upside down*, which makes it all wrong. It is the formula Mr. M. has condemned, and entitled "empirical."

The area Mr. M. calls 108 square feet, is only 65, and multiplied by the secant, it will be about 91 square feet.

Further, Mr. M. says, "the pressure constantly exerted by * * * is entirely independent of the velocity by which the vessel moves," = a given pressure in the steam cylinder can produce different velocities of the vessel! On which side of the equation does Mr. M. carry the circumstances? Next, as regards the acting area of the propeller, he says, "It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, &c.;" if we apply this to our proposed test, it will come out, the more pitch in proportion to the diameter, the greater the acting area of the propeller should be.

This is entirely opposite to the fact. It is a fact that, propellers with more pitch and slip, employ the effect better for propelling, (if they do not exceed $n = \frac{200}{P\,S}\sqrt{D}$ revolutions per minute,) but there is another reason, namely: *that a less acting area has a greater velocity, and that the resistance to the same is in proportion as the square of its velocity, and that the friction in the water is in proportion as the acting area.*

I will here add a formula on which this acting area should depend. Letters denote—

A = acting area of the propeller.		(less than 0·785 D^2.)
D = diameter	" "	(extreme.)
P = pitch	" "	
C = circumference	"	(at the diam. D.)

$$A = \frac{2{\cdot}5\ D^3}{\sqrt{P^2+C^2}}$$

This formula forms a part of the one given for finding the slip. The divisor $\sqrt{P^2+C^2}$ is a secant for an angle whose tang. = P and radii = *C*. When I can, I rather avoid trigonometrical expressions, but *simply* this will be, *multiply* the area of the propeller by the *sine* for the angle of the propeller blades to the axis at the periphery; the product should be the acting area.

Mr. M.'s theory is, *divide* the projecting area of the propeller blades by the *sine* for the same angle, when the pitch is the advance of the vessel during one revolution, the quotient should be the acting area of the propeller; expressed in a formula without trigonometry, it will be—

$$A = \frac{D\,L\,m\sqrt{P^2\,(1-s)^2+C^2}}{4\,P.}$$

C = a circumference taken at the centre of effort of the blades.
L = length of the propeller.
m = number of blades.
s = slip in a decimal fraction.

MARINE PROPULSION.

Fig. 1.

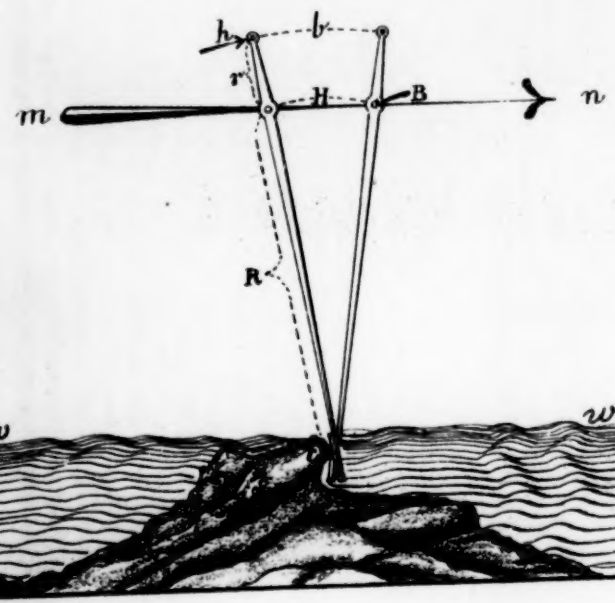
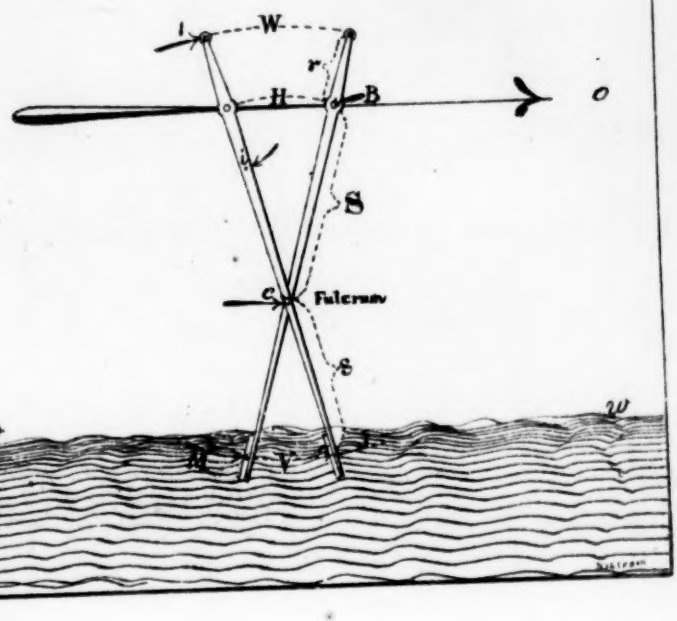


Fig. 2.



These four quantities have certainly something to do with the acting area, but they are not at all a measure of the same; they can vary considerably with the same acting area. But, the projecting area of the cylinder described by the propeller, multiplied or divided by some coefficient can not vary at such ad libitum. It appears to me, Mr. M. has mistaken the propeller for a paddle wheel, where his rules would be more likely to be applicable.

Mr. M.'s remarks about "action and reaction," I will not contradict, as I may be somewhat mistaken in the expression; but I will here explain how I understand it: action and reaction = pressure and resistance *in statics*. But in *dynamics* action and reaction = power.

When Mr. M. finishes his theory, he says: "such are the indications of theory, but it is found that the values given by them are but approximate." How is it possible that a theory composed of such incongruities ever can reach approximation? It is often the case that such a theory is applied in practice, and gives a wrong result, *then theory in general* is blamed. However, Mr. M.'s theory will surely do no harm in practice, because it is applicable *first*, when the work is finished. "And that there are some modifying circumstances experienced in practice." We cannot expect a result to come out nearer than the circumstances are carried, and Mr. M. says himself that "circumstances are generally on one side of the question."

After Mr. M. has repeated my statements based on Mr. Isherwood's error, he says: "The whole structure of the argument is built upon sand." *Yes, sir*, but I am not the builder; Mr. Isherwood first designed it, and applied it to the *San Jacinto*, and I made remarks upon it, stating it to be wrong, &c., &c.

But after all, I cannot find where Mr. M. proved my misapprehension in the first principles of dynamics; he says that the first equation "should have been $p = r$; consequently the results attained by it are valueless;" that is no proof at all, to say this is wrong; "consequently," *not right*.

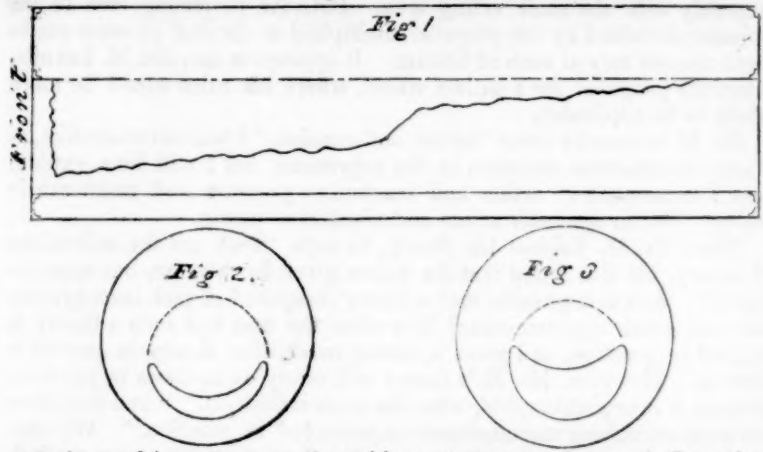
For the Journal of the Franklin Institute.

Steam Boiler Explosion in New York.

One of the boilers of the extensive sugar refinery of Messrs. Howell, King & Co., Duane street, New York, exploded early in the morning of the 12th of April, at the moment of starting the engine. There are four boilers in the set, each 6 feet in diameter, 40 feet long, with one flue 42 inches diameter; thickness of iron used in the shell, $\frac{5}{16}$-inch, and in flue, $\frac{3}{8}$-inch. The furnace is within the flue, at the front end. This form of boiler is the kind generally used with Cornish engines, and is capable of resisting a heavy pressure of steam.

In the present case, it will observed by fig. 1, which gives a longitudinal section of the boiler, that the top of the flue, at the front end, has been torn from the head of the boiler, and crushed nearly to the bottom. At the back head no fracture is visible, but there is evidence of severe strain. Fig. 2 is a cross section of the boilers at the front; and fig. 3 a

section at the centre; both showing the shape of the flue after the accident. The dotted lines in all three figures show the original form of the flue.



As is usual in such cases, the evidence before the Coroner's Jury (five men were severely injured, three of whom soon after died,) was very conflicting, so far as opinions went; but the following facts were elicited:

The engineer did not know the state of water, and could not tell any thing about it. The boilers were independent of each other, each having a safety valve, and also a screw valve, for shutting off or connecting with the other boilers. It is also stated, that baked molasses and bone-black were found around the safety valve after the explosion; and that the screw valve, which admitted the steam from this boiler into the common steam pipe, was found shut.

If we suppose the boiler to have had its full supply of water, and that the explosion was the result of an excess of steam, caused by the safety and screw valves being shut, we have three things to account for.

1st, Why did this one boiler generate such an excess of steam, while the other three in the same time had reached a pressure of but 35 pounds?

2d, The explosion took place at the starting of the engine, which, in the absence of positive testimony to the contrary, is considered good evidence of a short supply of water. 3d, The greatest depression in the flue, and the only fracture, is over the furnace, where there would be the least strength in case of low water.

If, on the other hand, we suppose the water to have been low in this boiler, as was thought by some of the witnesses, who judged from the appearance of the iron after the accident, then it would have generated a higher pressure of steam in the same time than the other boilers; and if we still further suppose that the screw valve of this boiler was not fully shut, (no reason was given for this valve being closed,) but that it would allow the passage of a small quantity of steam, then the starting of the engine would cause the water to rise over the heated surface of the flue, and the explosion follow in the usual way. The explosion may be explained by either mode, and as positive evidence is very limited, we may be at liberty to take either side of the question. H.

*Cornish Engines.**

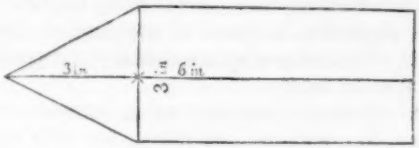
The number of pumping engines reported for Dec., 1851, is 20. They have consumed 1542 tons of coal; and lifted 13,000,000 tons of water 10 fathoms high. The average duty of the whole is, therefore, 50,000,000 lbs. lifted one foot high by the consumption of a bushel of coal weighing 94 lbs.—*Lean's Engine Reporter, Jan.* 5, 1852.

Hints on the Principles which should regulate the Forms of Boats and Ships, derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.*†

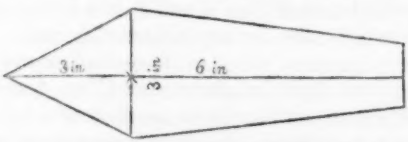
Continued from page 194.

Chapter VI.—Experiments relating to the Stern.

Experiment 17.—First, with the sides parallel and tapered. Two models having the same form of bow, an isosceles triangle of 3 inches perpendicular distance from the base, and 3 inches wide; with the bodies attached 6 inches long; one of them with parallel sides, the other tapered as shown in the diagram; scale, ¼-inch to one inch.



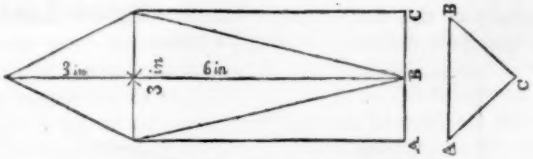
No. 1.—Weight 10 oz.; thickness 1½ inch.



No. 2.—Weight 10 oz.; thickness 1½ inch.

Upon being tested against each other, there appeared a slight degree of speed in favor of the parallel-sided model (No. 1), and decidedly greater stability than was possessed by the tapering-sided model (No. 2).

Experiment 18.—A third model (No. 3) of the same bows, length, width, and weight, was tested against No. 1; but having its sides beveled towards and at the stern.



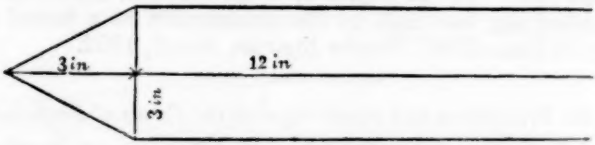
No. 3.—Weight 10 oz.; thickness 1½ inch.

The result of the trial was, that the speeds of No. 1 and No. 3 were equal; but No. 3 was inferior in stability, and sank deeper into the water than No. 1, and was less steady in its course.

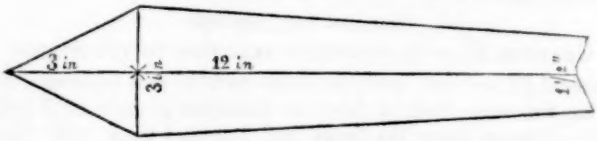
* From Herapath's Journal, January 17, 1852.

† From the London Architect for September, 1851.

Experiment 19.—Two models having the same form of bows as the preceding Nos. (1 and 2,) but with the bodies 12 inches long; one of them with the sides parallel, the other tapered, as exhibited in the diagrams marked Nos. 4 and 5.



No. 4.—Weight 17 oz.; thickness 1½ inch.



No. 5.—Weight 17 oz.; thickness 1½ inch.

When the models (Nos. 4 and 5) were tested together, the speed of No. 5, having tapered sides, was considerably inferior to the one with parallel sides; the proportion in speed of the parallel sides, to that of the tapered sides :: 3 : 2; and as respects stability, the parallel-sided model had very greatly the advantage.

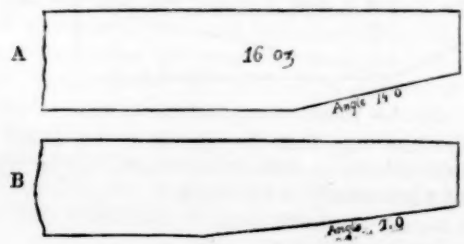
Experiment 20.—Again, experiment made between two models of the same form of bows, &c., as those just tested, but with the bodies of each lengthened to 18 inches; one having the sides parallel, the other tapered; indeed, both after the forms of Nos. 4 and 5, but longer by 6 inches. The weight of each equalled 1 lb. 7 oz.; thickness 1½ inch.

The speed, in this instance, between these models was not so dissimilar as in the trial with the two former models (Nos. 4 and 5); but still the tapering proved injurious, and in the proportion of 5 : 4.

In the experiments here given, they prove most decidedly that tapering the whole length of the body of a ship is very detrimental to speed.

The experiments next undertaken relate to the tapering of the under part or bottoms of ships towards and at the stern.

Experiment 21.—Two models of the same form of bows, and having their respective lengths, breadths, thickness, and weight equal; but one of them cut inclined up an angle of 14°, commencing at one-third of the length from the stern; the other also cut inclined up, but at an angle of 7°, and commencing at the mid-length, as in the diagrams A and B, which when tested together, A beat B in speed a trifle.



Experiment 22.—Again, a third model marked C, of the same dimensions and weight as A, but the bottom not cut inclined up; upon being tested with A, A had the greater speed of the two.

C

Weight 16 oz.

The model C was then tested with a model E, which differed from C by having its sides towards and at the stern inclined by a gentle curvature, commencing from near the midship. The balance rod gave the speed greatly in favor of the curve sides; for the model E required the additional weight of 2 oz. to be put into it to reduce its speed to an equality with the model C. The weight of each model equalled 16 oz.; therefore the speed of E was superior to the speed of C by one-eighth the weight.

Experiment 23.—Two models having the same form of bows, likewise the same breadth, length, depth, and weight; but one of them with parallel sides and bottom as the model C; the other, with the sides tapered curvilinearly towards and at the stern, and the bottom cut up inclined, and commencing in both instances at one-third or 6 inches from the stern; the length of each model 18 inches, and their respective weights 17 oz.

The difference of speed between these two models was great, and on the side of the curvilinear-formed stern, and nearly in the proportion of 3 : 2.

Experiment 24.—When the parallel-sided model (the one employed in the last experiment) had its sides made also curvilinear, but not the bottom, its speed, upon again testing the two last models together, was found to be improved very materially.

These latter experiments were tried against each other by weights, as well as by the difference of the length of lever, and the results were, that the model with curvilinear sides and inclined up bottom, beat in its speed the model with parallel sides and bottom, as to require the additional weight of 8 oz. to be put into the former to reduce its speed to an equality with the latter.

Experiment 25.—Upon shaping the parallel sides only to the curvilinear form of the swifter model, the speed of it was so far increased, in consequence, that 3 oz. extra weight was then sufficient to equalize the speed of both.

Experiment 26.—The curvilinear sides of the original parallel-sided model were next reduced to straight lines, the convexity of each being removed; and when tested with the swift model, it was found to be considerably injured in its speed, having lost by the alteration of the curves to straight lines, to the amount of $1\frac{1}{2}$ oz. in weight; because the now straight line tapered stern, required the additional weight of $4\frac{1}{2}$ oz. to be put into the swifter model, to equalize their speed, instead of 3 oz., when the sides were curvilinear.

The curve employed in the foregoing experiments was the segment of a circle, which subtended at the centre of the length of the straight line in the proportion of $\frac{1}{4}$-inch in 6 inches. The angle of the tapering, measured by straight lines, was 10°.

Experiment 27.—Having altered the curvature of the sides in another model, and from the subtension of ¼-inch to ½-inch in 6 inches of the length, the speed upon trial was proved to be deteriorated to the amount, in weight, of 1 oz. out of 2 oz., the previous speed, or injured by one-half. Indeed, after many experiments made with the view of thoroughly testing the principle of tapering of the sides and bottoms of models towards and at the stern, the results gave equal benefit; meaning, that when the sides were tapered, the improvement in the speed which followed was, when estimated by weight, equal to 4 oz. And the tapering of the bottom towards and at the stern, produced improvement in the speed likewise equal to 4 oz.; or 8 oz. altogether, in superiority of the model having its sides and bottom continued parallel and level.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 15, 1852.

Samuel V. Merrick, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Society of London; The Royal Geographical Society of London, and The American Institute of New York.

Donations were received from the Royal Geographical Society, London; The Statistical Society, London; The Royal Cornwall Polytechnic Society, Falmouth; The American Institute, City of New York; Hon. John Robbins, jr., Member Congress; Wm. Jackson, Esq.; The Maryland Institute, Baltimore, Maryland; Messrs. D. Appleton & Co, City of New York; John J. Hill, Esq., Albany, New York, and from Messrs. Henry Nolens, Dr. B. H. Rand, Dr. C. M. Wetherill, Geo. Harding, Frederick Graff, Dr. Isaac Parish, Blanchard & Lea, Prof. John F. Frazer, A. N. Macpherson, William Dougherty, and John Livezey, Philadelphia.

A work, entitled "Iconographic Encyclopedia of Science, Literature, and Art," was presented by several members of the Institute.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of March.

The Board of Managers and Standing Committees reported their minutes.

The Special Committees reported progress.

Resignations of membership (3) of the Institute were read and accepted.

New candidates for membership in the Institute (6) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

Dr. Rand, Chairman of the Committee on Meetings, exhibited several photographs on glass taken by the collodion process published in the Glasgow Practical Mechanics' Journal, December, 1851, (Journal Franklin Institute, vol. xxiii, 3d Series, p. 120.) These were taken by Dr. C. M. Cresson, and fully attest the value of this process. Dr. Rand remarked,

that from the improvements suggested by the daily experience of the gentlemen engaged in these experiments, he had no doubt that he should be able to submit at a future meeting, specimens of this art, which would present a decided advance over these brought forward this evening. He further called the attention of the members to a beautiful colored talbotype from the gallery of Messrs. M'Clees & Germon.

Dr. Rand brought before the meeting the subject of the flavoring of acidulous fruit drops. In these drops the characteristic flavor of the fruit represented, is so perfectly manifested as to have attracted general remark, being far more natural than in any preparation of the fruits heretofore made. He explained that these flavors were due to the presence of certain ethereal compounds, whose discovery and application to this purpose were of recent date; that it was most probable that the flavors of the fruits themselves depended on the presence of a very small quantity of these compounds produced by decomposition as the fruit approached and passed maturity.

In reply to an inquiry, Dr. Rand remarked that he believed that no possible injurious consequences could result to the health from swallowing the minute quantities of these ethers necessary to produce the desired flavor. The flavor of bitter almonds as used daily, is due to hydrocyanic acid, one of the most rapid poisons known when concentrated, but harmless as a flavoring substance. Of the injurious effects of acids upon the teeth and stomach, there could be no doubt, and this was the only objection he could perceive against this pleasant article of confectionery.

Dr. C. M. Wetherill exhibited specimens of various ethers, some of which were made for commercial purposes, by John Price Wetherill, Esq., the rest prepared by himself. These ethers were similar to those exhibited as flavoring extracts at the World's Fair, and which were examined by Dr. Hoffman.

The pear oil was acetate of oxide of amyle; apple oil, valerianate of oxide of amyle, and pineapple oil, butyrate of oxide of ethyle. These ethers require to be diluted with 5 to 7 volumes of alcohol to develope the peculiar flavor of the fruit. Dr. W. explained in full the theory of the alcoholic, amylic, viscous, lactic acid, and butyric acid fermentations; and illustrated the theory of organic radials by reference to the series of ethyle, amyle, and methyle.

Mr. J. Z. A. Wagner presented a new form of brick of his invention, having a mortise in its centre. The advantages claimed for this brick are, economy in fuel in its manufacture, less liability to absorb moisture, the ease with which it may be divided, and greater strength of wall constructed of bricks of this form.

Mr. Wagner also exhibited a model of an apparatus intended as a steam auxiliary to sailing vessels.

Mr. George Harding placed on the table a beautiful working model of the Morse line of magnetic telegraph between New York and Washington, made by Mr. Mason of this city.

Mr. G. W. Smith brought forward specimens of fabrics from the flax cotton of M. Claussen; some of these were composed of the prepared flax alone, others with a mixture of wool. Also some specimens of the material variously colored.